ANTENNA APPLICATIONS IN TWO-WAY RADIO SYSTEMS

RADIO & TV NEWS

MBER
1957
35 CENTS

World's Leading Electronics Magazine

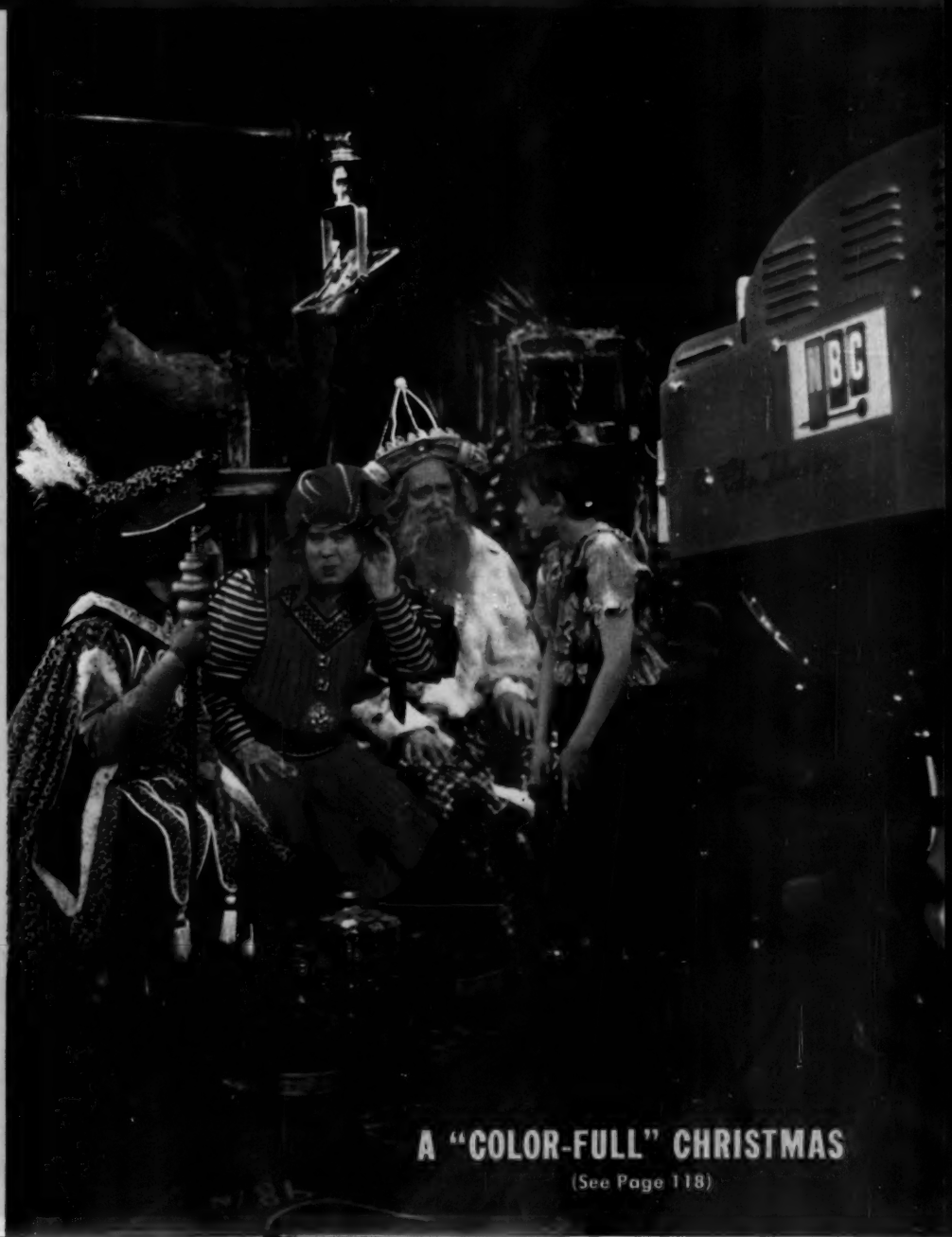
LECTRONIC FENCING
TOUCHE" INDICATOR

THE NEW G-E
PHONO CARTRIDGE

DELCO'S PORTABLE
AUTO RADIOS

STEREO
BALANCE AND GAIN
CONTROL

WIDE-RANGE
CRYSTAL MARKER
GENERATOR



A "COLOR-FULL" CHRISTMAS

(See Page 118)

for all set replacement work!

You'll save yourself trouble if you standardize on Raytheon "All-Set" Tubes for replacement work.

Here's why:

Raytheon "All-Set" Tubes are designed to give perfect service in many makes and models of receivers because Raytheon sells Tubes to almost every set manufacturer. To satisfy the many and varying needs of so many manufacturers, these tubes must combine top quality performance and dependability. This successful combination makes Raytheon "All-Set" Tubes tops for replacement.

Always use Raytheon "All-Set" Tubes to satisfy your "all-set" customers.

TV-Radio service is your business . . . serving you is ours

RAYTHEON MANUFACTURING COMPANY

Receiving and Cathode Ray Tube Operations

Newton, Mass. • Chicago, Ill. • Atlanta, Ga. • Los Angeles, Calif.

Raytheon makes all these { Receiving and Picture Tubes, Reliable Subminiature and Miniature Tubes, Semiconductor Diodes and Transistors, Nucleonic Tubes, Microwave Tubes.

RAYTHEON®

Excellence in Electronics

(See Page 118)

NOW—A Faster Way to Reach the Top in TV SERVICING

N.R.I. SENDS YOU 17" Picture Tube, Components for a TV Receiver, 5" Oscilloscope and Signal Generator . . . all parts for these 4 complete units.

N.R.I. All-Practice Method Trains You at Home in Spare Time to Fix TV Sets Quickly, with Confidence

The man who knows the answers—the Professional TV Technician enjoys the prestige, gets the better jobs, the higher pay. Here is the learn-by-practice training to be a Professional TV Technician. It shows you the way to be the boss, to earn top pay. Television Servicing needs more well trained men. If you have a basic knowledge of radio and electronics you can make some Television repairs simply by trial and error. But sooner or later you will face TV Service problems you can not solve. And you can't get the training you need while customers wait.

N.R.I. Is Oldest and Largest Home Study Radio-TV School

Over forty years experience and the record and reputation of N.R.I. back up this learn-by-doing Professional TV Servicing Course. Instead of just reading about TV problems, you build and conduct experiments on circuits in a TV receiver. You learn methods, "Tricks of the trade" proved by top TV Servicemen. You learn to fix any set, any model with confidence.

You Get COLOR TV Textbooks Early

The day you enroll, N.R.I. sends you special Color-TV books to speed your knowledge and understanding of this vast, growing phase of Television. Many full color pictures and diagrams help you recognize defects and help you learn how to correct them quickly and properly. To cash in on the coming Color TV boom, you'll need the kind of knowledge and experience this N.R.I. training gives.

This is 100% learn-by-doing, practical training. Here is a course for men who know basic theory, either from Radio or TV Servicing experience or planned training but realize the need for more knowledge to forge ahead. Here is what one graduate, G. G. Stethem of Belpre, Ohio, says, "I can not praise N.R.I.'s Professional TV Course highly enough. I have my own spare time shop and all the Radio-TV work I can handle."

Another graduate, Edward Ravitsky of Northumberland, Pa., says, "I have taken your course in Professional TV Servicing. It takes the kind of experience you offer to really learn." If you want to go places faster in TV Servicing, make your future more secure as the industry develops, we invite you to find out what you get, what you practice, what you learn from N.R.I.'s Course in Professional TV Servicing. Mail the coupon now. There is no obligation. NATIONAL RADIO INSTITUTE, Dept. 7NET, Washington 16, D. C.

Send for FREE BOOK

NATIONAL RADIO INSTITUTE
Dept. 7NET, Washington 16, D. C.

Please send FREE copy of "How to Reach the Top in TV Servicing." I understand no salesman will call.

Name..... Age.....

Address.....

City..... Zone..... State.....

ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL

RADIO & TV NEWS is published monthly by Ziff-Davis Publishing Company, William B. Ziff, Chairman of the Board (1946-1953), at 64 E. Lake St., Chicago 1, Ill. Entered as second-class matter July 21, 1948, at the Post Office, Chicago, Ill., under the act of March 3, 1879. Authorized by Post Office Department, Ottawa, Canada, as second-class matter. SUBSCRIPTION RATES: one year U. S. and possessions, and Canada $4.00; Pan American Union Countries $4.50; all other foreign countries, $5.00.

RADIO & TV NEWS

Reg. U. S. Pat. Off.

First in radio-television-audio-electronics

Average Net Paid Circulation 258,790

Radio & Television News • Radio News • Television News Trademarks Reg. U. S. Pat. Off.

Publisher
OLIVER READ, *D. Sc., W1ETI*

Editor
WM. A. STOCKLIN, *B. S.*

Technical Editor
MILTON S. SNITZER

Service Editor
SIDNEY C. SILVER

Associate Editor
P. B. HOEFER

West Coast Editor
EDWARD A. ALTSHULER

Assistant Editor
J. JUSTER

Television Consultant
WALTER H. BUCHSBAUM

Art Editor
HERBERT ASCHER

Art and Drafting Dept.
J. A. GOLANEK
JAMES A. ROTH
MILTON WHELPLEY

Advertising Director
JOHN A. RONAN, JR.

Advertising Manager
MURRAY GOLDMAN

Midwest Adv. Manager
JIM WEAKLEY

Western Adv. Manager
JOHN E. PAYNE

ZIFF-DAVIS PUBLISHING COMPANY

William Ziff, President; H. J. Morgenroth, Vice-President; Michael H. Froelich, Vice-President; Michael Michaelson, Vice-President and Circulation Director; George Carney, Secretary-Treasurer; Albert Gruen, Art Director.

Executive Office: 366 Madison Ave.
New York 17, N. Y. MU 7-8080
Editorial Office: 1 Park Ave.
New York 16, N. Y. MU 5-4367

Member
Audit Bureau of Circulations

MEMBER
INSTITUTE OF
HIGH FIDELITY MANUFACTURERS, INC.

BRANCH OFFICES: Midwestern Office, 64 E. Lake St., Chicago 1, Ill., John A. Ronan, Jr., manager; Western Office, Room 412, 215 W. 7th St., Los Angeles 14, Calif., John E. Payne, manager.

CONTENTS

DECEMBER, 1957 **VOL. 58 ■ NO. 6**

EDITORIAL—INDUSTRY NEWS

For the Record ..... *W. Stocklin* 8
Spot Radio News ..... *Washington Correspondent* 16
New Television Station Grants 16
Bureau of Standards Role in IGY 41
Subminiature Magnetic Amplifiers ..... *A. Hugh Argabrite* 70
Telemetry in Flight Testing (Part 2) ..... *Charles M. Downs* 72
Electronic News from France ..... *Prof. A. V. J. Martin* 92
Two TV Programs on One Channel 105
Calendar of Events 109
A "Color-full" Christmas 118
Fuel Cell Produces Electricity From Gases 177
Radio & TV News Index (Vols. 57-58) 182

HIGH FIDELITY AND AUDIO

Stereo Balance and Gain Control ..... *Herman Burstein & Henry C. Pollak* 42
All About Audio and Hi-Fi—Transients and Directional Effects (Part 7) ..... *G. A. Briggs* 60
Christmas Record Buying Guide 64
Preamp Kit Features Printed Circuits 65
New Hi-Fi Reluctance Phono Cartridge ..... *Roy Dally* 66
Hi-Fi—Audio Product Review 94
Certified Record Revue ..... *Bert Whyte* 107
Sound on Tape ..... *Bert Whyte* 110
RIAA Equalization for Early Preamps ..... *John F. Keidel* 114

SERVICING

Television-Radio

Delco's Portable Auto Radio 44
Servicing Three-Way AM Radios ..... *J. Richard Johnson* 46
Three Antennas on One Lead ..... *Charles Woodard* 48
The Magic of Color ..... *William Leonard* 50
Transistor Radio Troubleshooting ..... *Erich Gottlieb* 54
Westinghouse Color Circuits ..... *Walter H. Buchsbaum* 58
Mac's Service Shop ..... *John T. Frye* 74
Service Industry News 120
Antenna News 155
Strategy for C.O.D. Service ..... *Art Margolis* 162
Service Notes 180

Test Equipment

Get Sweep From Your Signal Generator ..... *Kung Yao* 47
Practical Color TV for the Technician (Part 5) ..... *Ken Kleidon* 62
New Tube Tester Data 142

AMATEUR AND COMMUNICATIONS

Antenna Applications in Two-Way Radio Systems ..... *Tom J. McMullin* 37
Sensitive R.F. Power Monitor ..... *Irving M. Gottlieb, W6HDM* 57
Wide-Range Crystal Marker Generator ..... *Harvey Pollack* 68

ELECTRONIC CONSTRUCTION

Electronic Fencing "Touché" Indicator ..... *Leon A. Wortman* 51

DEPARTMENTS

Within the Industry 32
What's New in Radio 164
Technical Books 169
Manufacturers' Literature 172

Copyright © 1957 by Ziff-Davis Publishing Company. All rights reserved.

SUBSCRIPTION SERVICE. All communications concerning subscriptions should be addressed to Circulation Dept., 64 E. Lake St., Chicago 1, Ill. Subscribers should allow at least four weeks for change of address. Include your old address as well as new—enclosing, if possible, an address label from a recent issue of this magazine.

CONTRIBUTIONS: Contributors are advised to retain a copy of their manuscripts and illustrations. Contributions should be mailed to the New York Editorial Office and must be accompanied by return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to whatever adaptations and revisions are necessary to meet the requirements of this publication. Payment covers all author's, contributor's, and contestant's rights, title, and interest in and to the material accepted and will be made at our current rates upon acceptance. All photos and drawings will be considered as part of the material purchased.

Wanted: Men of Vision

Men 17-55

Prepare Now for a Profitable Career in the Opportunity-Packed Fields of

ELECTRONICS

as used in

GUIDED MISSILES

ETC.

NO ADVANCED EDUCATION OR PREVIOUS TECHNICAL EXPERIENCE NEEDED!

Men who are planning a solid future and are anxious for a brighter tomorrow will find real opportunities in the big, fast-growing field of Electronics. Imagine being able to prepare for the advantages offered in Electronics without having advanced education—or previous technical experience! And what's so important, you can get this preparation in your spare time at home without interfering with your present job . . . following the same basic method used in our Chicago and Toronto training laboratories. Send coupon for FREE booklet NOW!

An INDEX To A Better Job, A Brighter Future

Industrial Electronics
Automation Electronics
Guided Missiles
Micro-Waves Communications
Radio Radar
Computers
Remote Control Systems
Broadcasting
Electronics Television
Your Own Service Shop

Live-Wire Employment Service

Puts you in touch with job opportunities—or helps you toward a better position in the plant where you are now employed.

"One of North America's Foremost Electronics Training Centers"

Accredited Member of National Home Study Council

Draft Age?

We have valuable information for every man of draft age; so if you are subject to military service, be sure to check the coupon.

FREE BOOKLET

We'll give you a free copy of an interesting booklet, "Electronics and YOU." See for yourself how you may take advantage of the opportunities in this fast-growing field.

DeVRY TECHNICAL INSTITUTE
CHICAGO 41, ILLINOIS
FORMERLY
DeFOREST'S TRAINING, INC.

MAIL TODAY FOR FREE FACTS

DeVry Technical Institute
4141 Belmont Ave., Chicago 41, Ill., Dept. RN-12-N

Please give me your FREE booklet, "Electronics and YOU," and tell me how I may prepare to enter one or more branches of Electronics as listed above.

Name _____ **Age** _____
Please Print
Street _____ **Apt.** _____
City _____ **Zone** _____ **State** _____

☐ **Check here if subject to Military Training.**

DeVry Tech's Canadian Training Center is located at 626 Roselawn Avenue, Toronto 12, Ontario

2023

OUT OF CONSIDERATION FOR SERVICEMEN WE USE

NO PRINTED CIRCUITRY

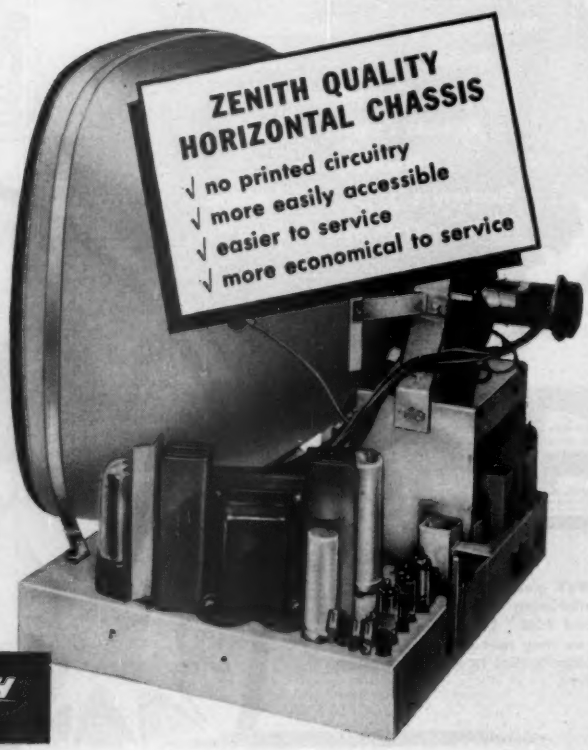
in our television chassis. Every servicing dealer knows that printed circuitry in a television chassis often leads to costly servicing and may also cause service delays. At Zenith we use *no* printed circuitry in our TV chassis, even though Dr. Alexander Ellett—the daddy of printed circuitry through his work with the U. S. Office of Scientific Research and Development—is head of our Research Department, and although Zenith was among the first to use printed circuitry in the proximity fuse. Zenith's handcrafted standard circuitry in television means greater operating dependability and fewer service headaches.

YES, IT COSTS US MORE TO DO IT THIS WAY,
WITH HANDCRAFTED STANDARD CIRCUITRY, BUT
IT MEANS MORE SATISFIED CUSTOMERS FOR ZENITH DEALERS

EASIER TO SERVICE . . . MORE ACCESSIBLE

HORIZONTAL CHASSIS

There are no screwball construction arrangements in Zenith's famed Horizontal Chassis that has established a reputation as the finest performing chassis in the industry—either in the fringes or close in. Zenith's Horizontal Chassis is more accessible and easier to service when servicing is required—another big advantage to servicemen and customers alike.



WE THINK IT'S WORTH THE EXTRA COST AND EXTRA CARE OF HANDCRAFTED STANDARD CIRCUITRY TO GET THE BEST PERFORMANCE AND LEAST SERVICE HEADACHES AND SO DO THOUSANDS OF DEALERS WHO WOULD SOONER SELL CUSTOMER SATISFACTION THAN A PRICE TAG!

ZENITH RADIO CORPORATION
CHICAGO 39, ILLINOIS

ZENITH

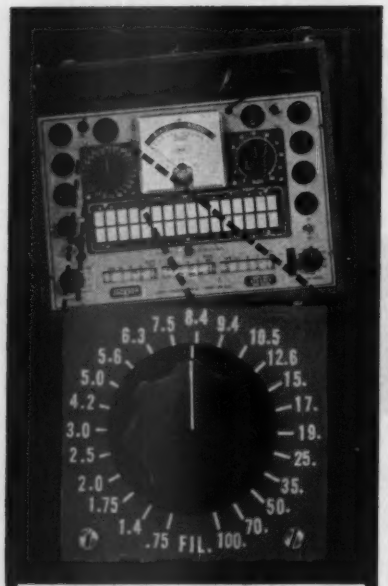
Here's one reason why

ZENITH TV

OUTPERFORMS THEM ALL...MEANS LESS SERVICE HEADACHES

Backed by 38 years of leadership in radionics exclusively. Also makers of Radio, High Fidelity Instruments and fine Hearing Aids.

The quality goes in before the Zenith name goes on.



23 Separate Heater Voltages on the Dynamic® JACKSON 648A Assure Accurate Tests for all Series-String Tubes ...The Correct Voltage for Every Known or Presently Planned Type.

YOU CAN MODERNIZE YOUR PRESENT 648

New 648 FV Kit provides same heater voltages as the new 648A Tester. Only four wires to solder. Installs in minutes. Available from your distributor now.

JACKSON ELECTRICAL INSTRUMENT CO.

"Service Engineered" Test Equipment

16-18 S. Patterson Boulevard • Dayton 2, Ohio
In Canada: The Canadian Marconi Company

For the RECORD

STEREO DISC FOR HI-FI

ANOTHER year has rolled by—and another New York High-Fidelity Show. We pushed and shoved our way around for five full days like every other guest attending the show. It was a successful affair. Some 40,338 hi-fi enthusiasts from all parts of the country and from abroad were in attendance and all the exhibitors were exceptionally pleased with the results, the handling of the show itself, and the interest shown on the part of the visitors.

Actually, from an equipment point of view there wasn't too much that was excitingly new. Manufacturers in this year's show seemed to have put greater emphasis on improved mechanical design and performance and, in many cases, innovations in housing designs.

Not directly connected with the show, but definitely as a result of it, news came fast of a new, revolutionary design. *London Records* announced and demonstrated its new stereo disc. Almost simultaneously an announcement and demonstration was made by the *Westrex Co.*, a division of *Western Electric Co.*, of its version of a stereo disc. Although both systems use a single stylus and single groove to obtain their two-channel separation, there is a wide difference between them. The *London* system uses hill-and-dale and lateral movement, while the *Westrex* system employs a special arrangement in which 45-degree motions of the stylus are used on both sides of the same groove.

Although your editors had heard of the tremendous success of another British unit demonstrated in London during the early part of this year, we were really amazed at the performance obtained from both of these systems at their New York debut. It is hard to say which scheme is the better system. Frankly, we liked the *London* system somewhat better but this may have been due to the fact that the listening conditions were far superior to those available at the *Westrex* demonstration.

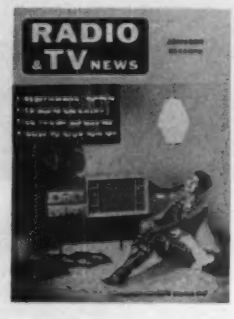
London's simultaneous announcement that stereo discs will be made available to the public within a year opens up a vast new area for the hi-fi enthusiast. Not in the sense that we didn't have it before, since we have had stereo tape for some time—but considering the lower price a vast new market will be opened. The discs themselves should sell at no greater price then standard pressings today. Another feature of importance is that the stereo cartridges that would be used with either system can be used for monaural recordings.

We doubt that the stereo disc will ever replace the stereo tape machine. It may cut into that market but we still believe that the ultimate in quality performance must go to the tape recorder.

Now that we have two systems, will we again run into the same problem that we had with 33⅓ rpm records *vs* 45 rpm? How well everyone in the industry, and even the consumer, remembers the confusion that existed then and even to this day. There certainly is no need for two similar systems and it would be wise if the leaders of the industry get together and come up with one answer and not two.

Integrated Speaker System

We have received many letters from our readers requesting further information on the *Integrand* servo-speaker system which was covered in our October issue. We are scheduled to hear a demonstration of the unit within the next week and if everything comes up to our expectations, as we believe it will, we will publish further details in our January, 1958 issue. . . . W. S.

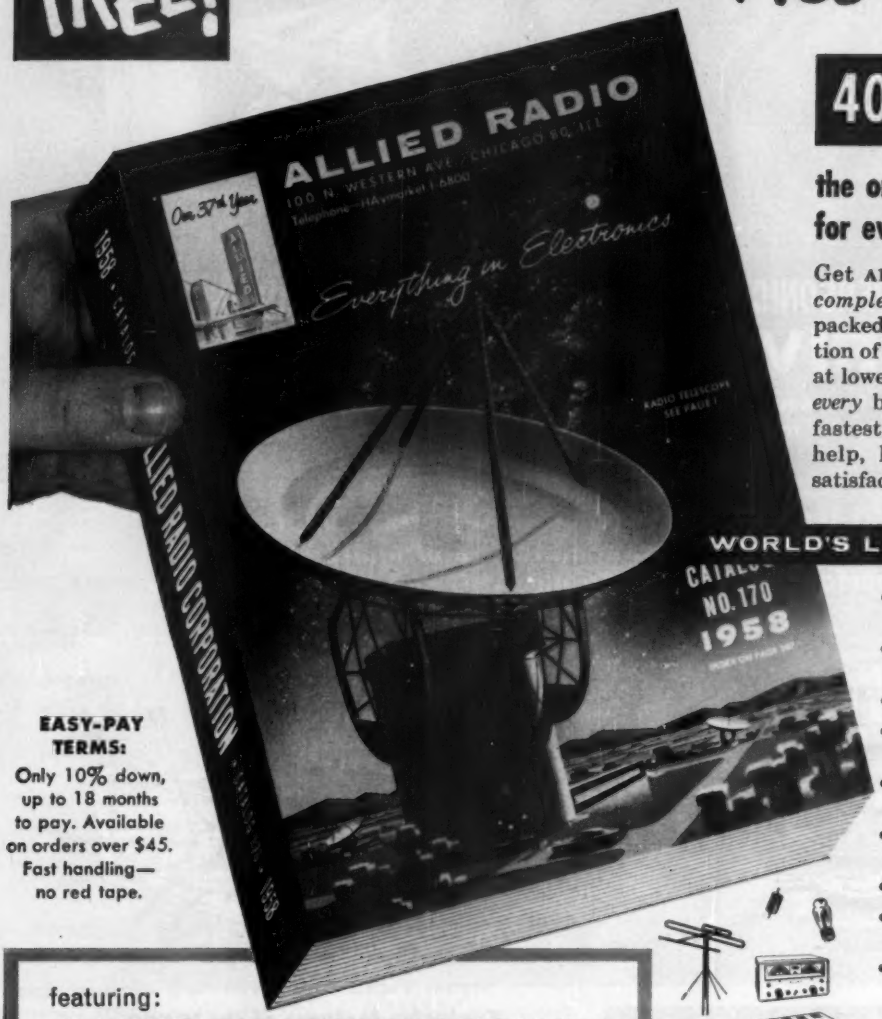


A NEW LOOK

By now everybody should be talking about the new RADIO & TV NEWS cover design. Starting with this issue, the cover has been changed to what we believe is a much more modern and attractive design. There will be no standard format as every cover will be analyzed and presented in the most attractive manner possible to fit in with the theme of the four-color photo. The January cover shown at the left is just another example of what is planned for the future. Don't miss it.

NEWEST University achievements in High Frequency reproduction!

FREE! ALLIED'S 1958 CATALOG



404 value-packed **PAGES**

the only COMPLETE catalog for everything in electronics

Get ALLIED's 1958 Catalog—it's *complete*, up-to-date—404 pages packed with the world's largest selection of quality electronic equipment at lowest, money-saving prices. Get *every* buying advantage at ALLIED: fastest shipment, expert personal help, lowest prices, guaranteed satisfaction...

EASY-PAY TERMS:
Only 10% down, up to 18 months to pay. Available on orders over $45. Fast handling—no red tape.

WORLD'S LARGEST STOCKS

- Latest Hi-Fi Systems and Components
- Money-Saving, Build-Your-Own KNIGHT-KITS
- Recorders and Supplies
- Public Address Systems and Accessories
- TV Tubes, Antennas and Accessories
- Amateur Receivers, Transmitters, Station Gear
- Test & Lab Instruments
- Specialized Industrial Electronic Equipment
- Huge Listings of Parts, Tubes, Transistors, Tools, Books

featuring:

ALLIED'S money-saving knight-kits:
Finest electronic equipment in money-saving kit form. Over 50 quality kits available—Hi-Fi amplifier, tuner and speaker kits, Hobby kits, Test Instruments, Ham kits (see our KNIGHT-KIT values elsewhere in this publication). ALLIED KNIGHT-KITS are easiest to build and they SAVE YOU MORE.

EVERYTHING IN HI-FI
World's largest selection of quality Hi-Fi components and complete music systems—available for immediate shipment from stock. Save on exclusive ALLIED-Recommended complete systems. Own the best in Hi-Fi for less!

Our 37th Year

ALLIED RADIO
World's Largest Electronic Supply House

send for the leading electronic supply guide **FREE!**

ALLIED RADIO CORP., Dept. 1-M7
100 N. Western Ave., Chicago 80, Ill.

☐ Send FREE 404-Page 1958 ALLIED Catalog

*Name*_____

*Address*_____

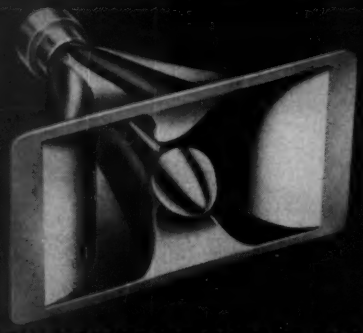
*City*_____ *Zone*____ *State*_____

NEWEST *University* achievements in High Frequency reproduction!

NEW HYPERSONIC

T-50 DRIVER*

Smooth, distortion-free sound reproduction from 600 cps to inaudibility!

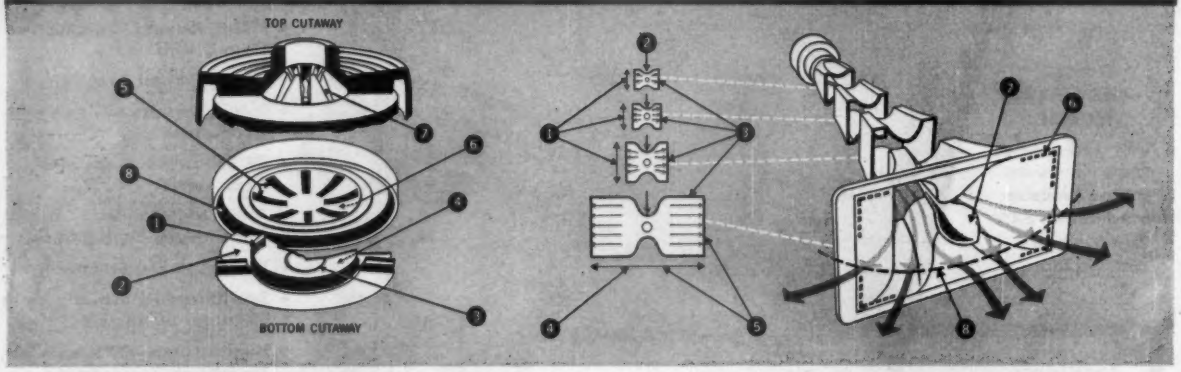


NEW RECIPROCATING-FLARE†

H-600 HORN

Uniform, wide-angle dispersion of sound over the entire operating range!

NOW – add the T-50 Driver or H-600 Horn to *improve* your existing equipment . . . or, achieve the *ultimate* in high frequency performance by using the T-50 and H-600 together



Exclusive features of the T-50

(1) Individually-wound aluminum voice coil has maximum high frequency efficiency. (2) Placed at the rear, enclosed side of diaphragm protects it against external damage and foreign matter. (3) Diaphragm is zonally re-enforced with concentric rib for maximum piston action, (4) and has convex radiating surface that achieves maximum uniformity of high frequency path lengths into mixing chamber. (5) Radial apertures in new phase-matching mixing chamber transmit all path lengths equally, (6) and reduce radial transmission impedance between diaphragm and mixing chamber surface, permitting tight spacing of diaphragm to mixing chamber surface for high frequency extension. (7) Constant cross-sectional area of die-cast mixing chamber apertures provides perfect acoustic match from diaphragm to throat of horn. (8) Diaphragm and mixing chamber are rim-centered on magnetic pot structure for optimum voice coil and gap alignment.

SPECIFICATIONS: Response: 600 cps to inaudibility; **Recommended crossover:** 700 cps; **Power capacity:** 50 watts, integrated program; **Diameter:** 4¼"; **Depth:** 4⅛"; **Throat:** 1⅜"—18 thread; **$49.50 net**

**Patent pending*

Exclusive features of the H-600

(1) Initial expansion of precision die-cast aluminum horn grows larger and larger in vertical direction (2) while central contouring profiles get deeper and deeper (3) building up sound pressure more and more into the horizontal direction (4) and when contoured sound has been fully developed within horn, horn expansion in the horizontal direction (5) takes over (6) until both ultimate expansion of horn and sound pressure are coordinated in the horizontal plane at the mouth (7) which is designed large enough to present a smooth radiation characteristic down to the lowest wave lengths (8) and where a radiating plane wave front equalizer (9) smoothens out the wave front to give an even, wide horizontal sound pattern.

SPECIFICATIONS: Air column: 7¾"; **Horn Cut-off:** 600 cps; **Recommended crossover:** 700 cps; **Dispersion:** 125° horiz. x 55° vert.; **Bell mouth:** 8¾" x 4¾" over-all; **Depth (less driver):** 7¾"; **Throat:** 1⅜"—18 thread; **$18.00 net**

†*U.S. patent #2,690,231*

More University tweeters, mid-range horns and drivers . . . for maximum versatility of application and flexibility of operation

HF-206 Hypersonic Tweeter. Response to inaudibility. Crossover 5000 cps. Wide angle "reciprocating flare" die-cast aluminum horn. 8 ohms $33.00 net.

UXT-5 Super Tweeter. Crossover 5000 cps up. Wide-angle response to 17,500 cps. 8 ohms. $21.00 net.

4401 Tweeter. Crossover 2500 cps up. Wide-angle response to 15,000 cps. 8 ohms. $18.00 net.

T-30 High Frequency Driver. As tweeter with H-600 in 2-way system; as mid-range with H-600 or Cobreflex in 3 or 4-way. Response: 200-15,000 cps. 8 ohms. $30.00 net.

Cobreflex Horn. Crossover 350 cps up. Exclusive twin-flared 27" exponential air column. Dispersion: 120° x 60° Heavy precision aluminum die casting. $23.00 net.

LISTEN *University® sounds better*

UNIVERSITY LOUDSPEAKERS, INC., 80 SOUTH KENSICO AVE., WHITE PLAINS, N. Y.

6 months from today

WHICH WILL YOU HOLD...

OR

add technical training to your practical experience. GET YOUR FCC LICENSE QUICKLY!

then use our effective

Job Finding Service!

We Guarantee
to train you until you receive
Your FCC License

If you fail to pass your Commercial License exam after completing our course, we guarantee to continue your training without additional cost of any kind until you successfully obtain your Commercial License.

Here's proof FCC Licenses can be secured in a few hours of study with our training at home in spare time.

Name and address	License	Time
John J. Johnson Boise City, Okla.	1st Class	20 weeks
Prentice Harrison, Lewes, Delaware	1st Class	27 weeks
W. E. Evey, Ottawa, Kansas	2nd Class	24 weeks
J. A. Niedeck, Bethlehem, Pa.	2nd Class	8 weeks
Gerald J. Collier, Columbus, Ohio	2nd Class	16 weeks

Employers Make Offers Like These

to Our Graduates Every Month

Broadcast Station in Illinois: "We are in need of an engineer with a first class phone license, preferably a student of Cleveland Institute of Radio Electronics; 40 hour week plus 8 hours overtime."

West Coast Manufacturer: "We are currently in need of men with electronics training or experience in radar maintenance. We would appreciate your referral of interested persons to us."

Our Trainees Get Jobs Like These Every Month

CHIEF ENGINEER

"Since enrolling with Cleveland Institute I have received my 1st class license, served as a transmitter engineer and am now Chief Engineer of Station WAIN. I also have a Motorola 2-way Service Station. Thanks to the Institute for making this possible."

Lewis M. Owens, Columbia, Ky.

TEST ENGINEER

"I am pleased to inform you that I recently secured a position as Test Engineer with Melpar, Inc. (Subsidiary of Westinghouse) A substantial salary increase was involved. My Cleveland Institute training played a major role in qualifying me for this position."

Boyd Daugherty, Falls Church, Va.

Names of Trainees in Your Area
Provided on Request

Carl E. Smith, E.E., President

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Dept. RN-12, 4900 Euclid Bldg., Cleveland 3, Ohio

Get these valuable Booklets

FREE!

Accredited by the National Home Study Council

Cleveland Institute of Radio Electronics

Dept. RN-12, 4900 Euclid Bldg., Cleveland, Ohio

Please send Free Booklets prepared to help me get ahead in Electronics. I have had training or experience in Electronics as indicated below:

- ☐ Military
- ☐ Radio-TV Servicing
- ☐ Manufacturing
- ☐ Amateur Radio
- ☐ Broadcasting
- ☐ Home Experimenting
- ☐ Telephone Company
- ☐ Other.....

In what kind of work are you now engaged? .....

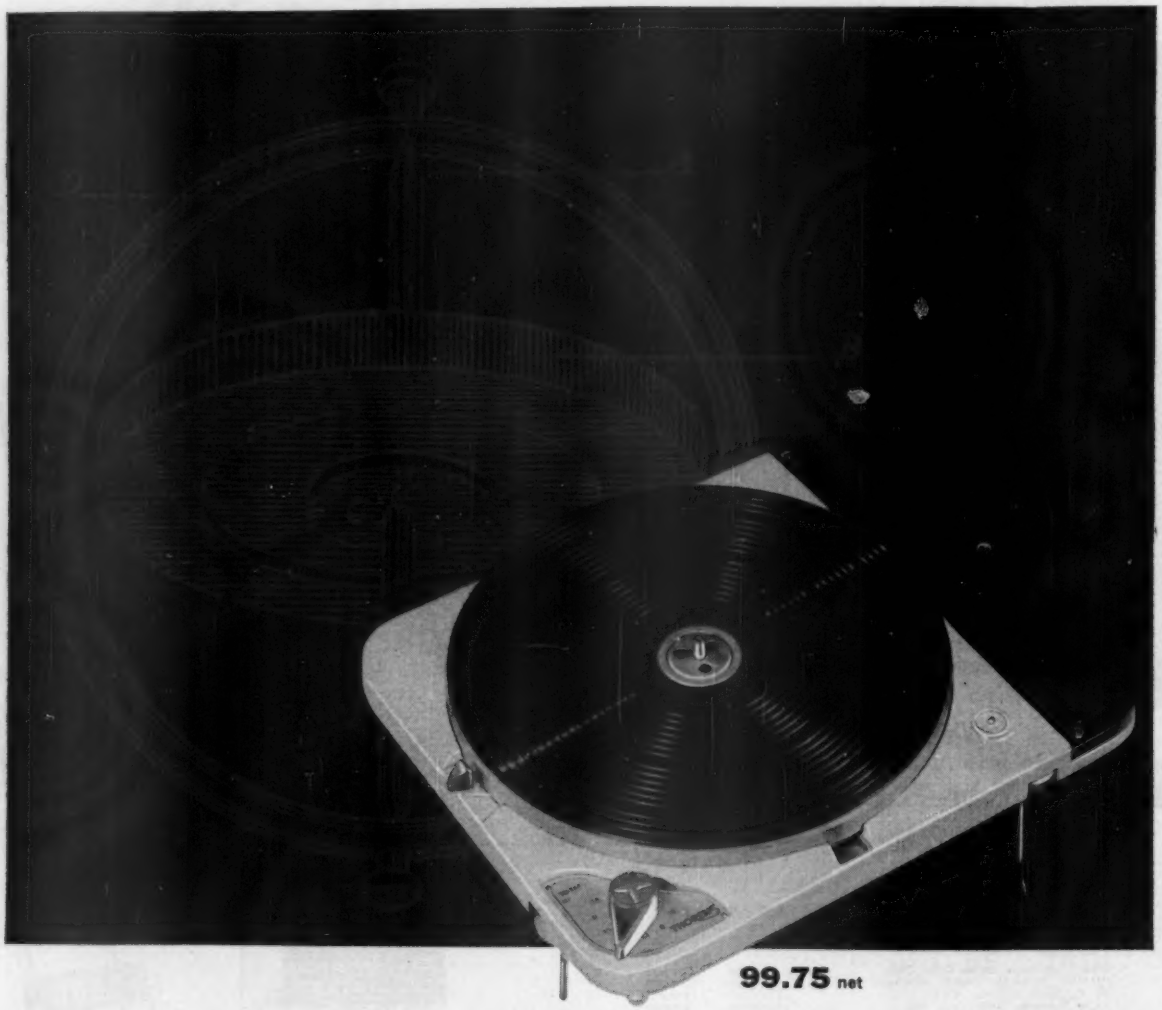
In what branch of Electronics are you interested? .....

Name.....Age.....

Address.....

City.....Zone.....State.....

Special Tuition Rates to Members of Armed Forces RN-12



99.75 net

NEW 12" PRECISION TURNTABLE

OUTSTANDING FEATURES

Four speeds, each with +3% speed adjustment. Built-in illuminated strobe disk for all speeds. Built-in level bubble and leveling screws. Precision 4-pole motor, extra-compliant belt-drive and idler system plus exclusive Thorens Roto-Drive principle, provide complete vibration isolation, absolutely constant speed. Provision for easily changing arms without leaving unsightly permanent marks:—just replace low-cost arm mounting board, available for 12" or 16" arms in various finishes. Easy to mount, the TD-124 requires only 2¾" clearance below mounting board. Furnished with attached line cord, shielded cable and solder plate.

Gyro-like Roto-Drive gives new Thorens TD-124 absolute speed uniformity. Heavier than 16-inch turntables, yet it starts, stops in less than 2/3 turn!

How to get the heaviest possible turntable for smooth, absolutely quiet operation without sacrificing fast starts and stops.

That's the problem Thorens engineers faced when they set out to build the best four-speed, 12-inch, hi-fi turntable money can buy. You'll be amazed at the simplicity of their solution.

The new TD-124 really has two turntables in one: (1) a heavy 10-lb. rim-concentrated, cast-iron flywheel (outweighs 16" aluminum turntables) (2) a light aluminum cover, or turntable proper. An exclusive, Thorens-originated clutch couples or decouples the light aluminum table to the heavy flywheel for instant starts and stops. What's more, the Thorens double turntable system gives you the weight of a cast-iron table (3 times as heavy as aluminum) without danger of attracting any pickup magnet. And with this unique construction, your pickup gets magnetic shielding from motor or transformer hum fields by the iron turntable.

Ask your hi-fi dealer to show you the Thorens TD-124. Better yet, arrange to hear one of those critical, slow piano records on the TD-124. If you don't know who your dealer is, write Thorens Company, Dept. R127, New Hyde Park, N.Y. 7.9

THORENS ★ FULL YEAR GUARANTEE ★ SWISS MADE PRODUCTS

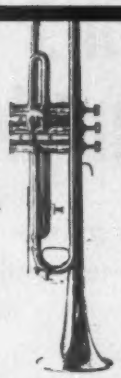
THORENS SWISS MADE PRODUCTS

HI-FI COMPONENTS · LIGHTERS · SPRING-POWERED SHAVERS · MUSIC BOXES

ALTEC®

SPEAKER COMPONENTS

designed for the most natural . . . most faithful sound reproduction



ALTEC LANSING speaker components exemplify the ALTEC tradition to give the most faithful reproduction of sound obtainable through the most natural means.

ALL of these ALTEC high frequency horns are of the sectoral, exponential type which provides a clear, mathematically calculated flow path to direct the sound waves into the proper distribution pattern without interfering with their natural propagation in the air. These sectoral horns provide efficient distribution control at all frequencies, unlike diffusion and other types which have wide distribution at the lower frequencies and become extremely directional and inefficient in the higher ranges.

These sectoral horns and their associated driving elements represent the only true method for obtaining high efficiency, full dynamic range, smooth frequency response and wide, regular distribution of high frequency sounds.

Have the pleasure of listening to a two-way speaker system of ALTEC LANSING speaker components at your dealer's. If your ear is in tune, you'll take ALTEC home.

511B HORN

This new ALTEC high frequency horn is the finest available for home use. When used with the ALTEC 802D high frequency driver the 511B gives amazingly smooth response throughout the range from 500 to 22,000 cycles, one-half octave above the range of the human ear. The ALTEC 803 bass speaker, either singled or paired, is recommended as a bass component for use with this horn. The 500D dividing network is needed to complete this system.

PRICE: $36.00

811B HORN

This superb ALTEC horn is identical in design concept and quality with the 511B but is smaller and has a frequency range from 800 to 22,000 cycles. The 811B with the 802D driver can be used with the ALTEC 803A bass speaker or with the 415A Biflex to extend this wide range speaker to a full 22,000 cycle system.

PRICE: $27.00

802D HIGH FREQUENCY DRIVER

Designed specifically for use with the 511B and 811B horns for smooth 500 to 22,000 cycle high frequency reproduction.

Power: 30 watts; Range: 500–22,000 cycles; Impedance: 16 ohms; Magnet Weight: 1.3 lbs

PRICE: $57.00

3000B HIGH FREQUENCY SPEAKER AND NETWORK

This newly developed high frequency speaker and horn used with the 3000B network is the ideal unit to extend the range of the ALTEC 412A and 415A Biflexes or of any efficient 12" or 15" cone speaker to a full 22,000 cycles. The dividing network separates high and low frequencies at 3000 cycles, crossing over at a smooth 12 db per octave curve.

Speaker—Power: 20 watts; Impedance: 8 ohms; Range: 3,000–22,000 cycles

PRICE: $39.00

Network—Impedance: 8 ohms; HF Attenuation: 10 db continuously variable; Crossover: 3000 cycles

PRICE: $21.00

500D DIVIDING NETWORK

For use with the 802D h.f. driver and 511B horn. Has smooth 12 db per octave slope and detented high frequency shelving control designed for external mounting with 4 steps of 1½ decibels each for precise adjustment to individual rooms.

Impedance: 16 ohms; HF attenuation: 6 db, 1½ db steps; Crossover: 500 cycles

PRICE: $54.00

803A BASS SPEAKER

The 803A is used as the bass component in many of ALTEC's larger theatre speaker systems. Since it is intended for use with the 802D high frequency driver and either the 511B or 811B horn its efficient frequency range is limited to 30–1600 cycles. This 1600 cycle upper range assures a smooth crossover at any frequency up to 800 cycles. As a result the 803A has a bass performance far superior to that of loudspeakers designed to operate over a wider frequency spectrum.

Power: 30 watts; Impedance: 16 ohms; Range: 30–1600 cycles; Magnet Weight: 2.4 lbs

PRICE: $60.00

800E DIVIDING NETWORK

Has the same characteristics as the 500D but with 800 cycle crossover for use with the 811B horn and 802D h.f. driver.

Impedance: 16 ohms; HF Attenuation: 6 db, 1½ db steps; Crossover: 800 cycles

PRICE: $42.00

ALTEC®

LANSING CORPORATION

ALTEC LANSING CORPORATION
1515 S. Manchester Avenue, Anaheim, Calif.
161 Sixth Avenue, New York 13, N.Y.

Write for free catalogue Dept. TM12

Ad #12-11

HOW WOULD YOU LIKE TO BREAK INTO

Bull's-eye every time!

We hit the target again . . .
with this new, modern version of the most wanted service-test instrument.

MODERN DESIGN

VERSATILE

DEPENDABLE

TIME SAVING

Pyramid introduces the CRA-2 Capacitor-Resistor Analyzer, a versatile, up-to-date, moderately priced test instrument. The CRA-2 is the perfect multi-purpose analyzer for the technician, serviceman and engineer, in industrial and military electronics, black and white, and color television, and all related fields.

The guesswork has been removed from circuit trouble shooting. When making leakage-current measurements, the values are read directly from the meter while the rated operating voltage is applied to the capacitor. A vacuum-tube ohmmeter circuit displays accurate insulation-resistance values on the meter for many types of capacitors. The extended range calibrated power factor control permits power factor measurements of electrolytic capacitors rated as low as 6 volts DC working and as high as 600 volts DC working. This special "QUICK CHECK" circuit performs rapid "IN CIRCUIT" test for short, open, intermittent high RF impedance and high power factor without removing or disconnecting the component from its operating circuit.

FEATURES

"Quick Check" in circuit test for Open Circuits. Short Circuits. Intermittents. High RF Impedance. High Power Factor.

Speedily and accurately checks: Capacitance. Power Factor. Resistance. Insulation-Resistance. Leakage Current.

Precision meter for accurate readings of leakage current, applied voltage and insulation resistance.

Combination Wien and Wheatstone bridge.

Accurate vacuum-tube meter circuit.

Parts of the highest quality are used. Wire and wiring meet military specifications.

Examine it today
Being introduced by leading Electronic Parts Distributors

PYRAMID ELECTRIC COMPANY
1445 Hudson Blvd., North Bergen, New Jersey

HOW WOULD YOU LIKE TO BREAK INTO ENGINEERING STARTING NEXT MONTH?

Your start in Engineering could mean higher pay, more interesting work, a real chance for advancement. Here's how to do it—fast!

A career in Engineering may be closer than you think, whatever your age or education or present job.

You know about the tremendous demand for engineers and technicians. But do you know how easy it is to get the training that will qualify you for this vital work, and how quickly you can advance?

First Step Wins Job Consideration

The moment you enroll for a course in Engineering you're in a position to change your job. I.C.S. Engineering Courses, for example, start you off with Basic Mathematics and Drafting. Most employers are quick to accept men who start technical training.

Your Advancement Is Rapid

Your interest, your determination, your willingness to spend free hours improving yourself all work in your favor. But your mastery of engineering subjects is what wins you the biggest boosts.

The I. C. S. method makes it possible for you to learn while you earn, to qualify yourself for upgrading step by step—from Draftsman to Detail Designer to Engineering Technician to full-fledged Engineer. It's a plan fitted to your needs, with personalized instruction and guidance, and, if you like, regular progress reports to your employer.

Mail Coupon for Free Books

If you are seriously interested in a fresh start in an opportunity-packed field, then mark and mail the coupon today. We'll send you *three* free books—(1) the 36-page career guide "How to Succeed," (2) Opportunity outlooks in your field of interest, (3) sample lesson (Math) demonstrating I. C. S. method.

For Real Job Security—Get an I. C. S. Diploma! **I. C. S., Scranton 15, Penna.** Accredited Member, Nat'onal Home Study Council

INTERNATIONAL CORRESPONDENCE SCHOOLS ICS

BOX 14147L, SCRANTON 15, PENNA. (Partial list of 257 courses)

Without cost or obligation, send me "HOW to SUCCEED" and the opportunity booklet about the field BEFORE which I have marked X (plus sample lesson):

ARCHITECTURE and BUILDING CONSTRUCTION
- ☐ Air Conditioning
- ☐ Architecture
- ☐ Arch. Drawing and Designing
- ☐ Building Contractor
- ☐ Building Estimator
- ☐ Carpentry and Millwork
- ☐ Carpenter Foreman
- ☐ Heating
- ☐ Interior Decoration
- ☐ Painting Contractor
- ☐ Plumbing
- ☐ Reading Arch. Blueprints

ART
- ☐ Commercial Art
- ☐ Magazine & Book Illus.
- ☐ Show Card and Sign Lettering
- ☐ Sketching and Painting

AUTOMOTIVE
- ☐ Automobiles
- ☐ Auto Body Rebuilding and Refinishing
- ☐ Auto Engine Tuneup
- ☐ Auto Technician

AVIATION
- ☐ Aero-Engineering Technology
- ☐ Aircraft & Engine Mechanic

BUSINESS
- ☐ Accounting
- ☐ Advertising
- ☐ Business Administration
- ☐ Business Management
- ☐ Cost Accounting
- ☐ Creative Salesmanship
- ☐ Managing a Small Business
- ☐ Professional Secretary
- ☐ Public Accounting
- ☐ Purchasing Agent
- ☐ Salesmanship
- ☐ Salesmanship and Management
- ☐ Traffic Management

CHEMICAL
- ☐ Analytical Chemistry
- ☐ Chemical Engineering
- ☐ Chem. Lab. Technician
- ☐ Elements of Nuclear Energy
- ☐ General Chemistry
- ☐ Natural Gas Prod. and Trans.
- ☐ Petroleum Prod. and Engr.
- ☐ Professional Engineer (Chem)
- ☐ Pulp and Paper Making

CIVIL ENGINEERING
- ☐ Civil Engineering
- ☐ Construction Engineering
- ☐ Highway Engineering
- ☐ Professional Engineer (Civil)
- ☐ Reading Struc. Blueprints
- ☐ Structural Engineering
- ☐ Surveying and Mapping

DRAFTING
- ☐ Aircraft Drafting
- ☐ Architectural Drafting
- ☐ Drafting Machine Design
- ☐ Electrical Drafting
- ☐ Mechanical Drafting
- ☐ Sheet Metal Drafting
- ☐ Structural Drafting

ELECTRICAL
- ☐ Electrical Engineering
- ☐ Elec. Engr. Technician
- ☐ Elec. Light and Power
- ☐ Practical Electrician
- ☐ Practical Lineman
- ☐ Professional Engineer (Elec)

HIGH SCHOOL
- ☐ High School Diploma

- ☐ Good English
- ☐ High School Mathematics
- ☐ Short Story Writing

LEADERSHIP
- ☐ Industrial Foremanship
- ☐ Industrial Supervision
- ☐ Personnel-Labor Relations
- ☐ Supervision

MECHANICAL and SHOP
- ☐ Diesel Engines
- ☐ Gas-Elec. Welding
- ☐ Industrial Engineering
- ☐ Industrial Instrumentation
- ☐ Industrial Metallurgy
- ☐ Industrial Safety
- ☐ Machine Design
- ☐ Machine Shop Practice
- ☐ Mechanical Engineering
- ☐ Professional Engineer (Mech)
- ☐ Quality Control
- ☐ Reading Shop Blueprints
- ☐ Refrigeration and Air Conditioning
- ☐ Tool Design ☐ Tool Making

RADIO, TELEVISION
- ☐ General Electronics Tech.
- ☐ Industrial Electronics
- ☐ Practical Radio-TV Eng'r'g
- ☐ Practical Telephony
- ☐ Radio-TV Servicing

RAILROAD
- ☐ Car Inspector and Air Brake
- ☐ Diesel Electrician
- ☐ Diesel Engr. and Fireman
- ☐ Diesel Locomotive

STEAM and DIESEL POWER
- ☐ Combustion Engineering
- ☐ Power Plant Engineer
- ☐ Stationary Diesel Engr.
- ☐ Stationary Fireman

TEXTILE
- ☐ Carding and Spinning
- ☐ Cotton Manufacture
- ☐ Cotton Warping and Weaving
- ☐ Loom Fixing Technician
- ☐ Textile Designing
- ☐ Textile Finishing & Dyeing
- ☐ Throwing
- ☐ Warping and Weaving
- ☐ Worsted Manufacturing

Name_____ Age_____ Home Address_____

City_____ Zone_____ State_____ Working Hours_____ A.M. to P.M._____

Occupation_____

Canadian residents send coupon to International Correspondence Schools, Canadian, Ltd., Montreal, Canada. . . . Special tuition rates to members of the U. S. Armed Forces.

The "King of Instruments"
—an Aeolian-Skinner organ installation.

THE sound of the organ is one of the most difficult to reproduce, because of its wide tonal and dynamic range, and because of the large amount of fundamental energy that appears at extreme bass frequencies.

At a recent public demonstration, staged by the Audio League at St. Mark's Church, Mt. Kisco, N. Y., the recorded sound of an Aeolian-Skinner organ (from stereo tape) was instantaneously alternated with that of the "live" instrument. The reproducing equipment selected included four AR-1 speaker systems. Here is some of the press comment on the event:

The Saturday Review *(David Hebb)*

"Competent listeners, with trained professional ears, were fooled into thinking that the live portions were recorded, and vice versa. . . . The extreme low notes were felt, rather than heard, without any 'loudspeaker' sound . . ."

AUDIO *(Julian D. Hirsch)*

"Even where differences were detectable at changeover, it was usually not possible to determine which sound was live and which was recorded, without assistance from the signal lights. . . . facsimile recording and reproduction of the pipe organ in its original environment has been accomplished."

audiocraft

"It was such a negligible difference *(between live and recorded sound)* that, even when it was discerned, it was impossible to tell whether the organ or the sound system was playing!"

The price of an AR-1 two-way speaker system, including cabinet, is $185.00 in mahogany or birch. Descriptive literature is available on request.

ACOUSTIC RESEARCH, INC.
24 Thorndike St., Cambridge 41, Mass.

Spot Radio News

★ **Presenting latest information on the Radio Industry.**

By RADIO & TV NEWS
WASHINGTON EDITOR

THE HISTORIC TRIAL-TEST PAY-SEE TV edict issued a short while ago by the Commission, has, in the opinion of most legislators in Washington, set the stage for firm action by not only Congress, but industry, too. And a number of members of the Congress have lost no time in getting down to business and scheduling hearings.

Representative Oren Harris, chairman of the House Interstate and Foreign Commerce Committee, told the Washington press that he would convene his group in January and hold public hearings on the FCC's *qualified* approval of subscription tests for television. Not only would the headman of the Commission be called on to testify, Congressman Harris said, but other members of the FCC would be asked to appear.

The House committee will be asked to study very carefully any applications submitted by potential toll-TV operators to determine whether the experimental charge plan would be in the public interest.

The Congressman, who has written to the FCC on several occasions questioning its statutory position in authorizing toll-TV, noted that he has warned the agency not to approve any tests of subscription television without getting prior clearance from the Interstate Commerce Committee.

Other Congressmen were equally critical of the Commission. Said Rep. Emanuel Celler: "The proposed tests contained a calculated risk . . . for free . . . broadcasts."

In his opinion, Congress should rule on the issue before any experiments are undertaken, because pay-TV poses a . . . "grave threat to the public interest." Noting that the Commission's legal authority to proceed with such tests were ". . . dubious at best . . ." the member of the House said that even on an experimental basis, fee television . . . "may bring in its train a number of disastrous consequences."

The Congressman said that he felt confident . . . "that once Congress undertakes such consideration, the Commission will defer final decision in respect to experimental pay-TV until the Congress has resolved the problem."

Senators also joined the army of protesters. Outspoken Senator Charles Potter, a member of the powerful Senate Interstate and Foreign Commerce Committee, said that he must . . . "with regret, disapprove of the FCC's action . . . and the Committee will be asked to instruct the FCC to hold off or postpone any action until Congress has had an opportunity to study thoroughly the problem."

He, too, stressed the fact that the FCC lacked the authority to rule on pay-TV, and even if the agency did, the matter should still be brought be-

NEW TELEVISION STATION GRANTS

An additional listing of new construction permits and changes that have been made in station call letters. List continued next month.

STATE	CITY	CALL	CHANNEL	FREQUENCY	POWER*
Montana	Butte	.....	6	82-88	66.072

NEW CALL LETTER ASSIGNMENTS

STATE	CITY	CALL	CHANNEL	FREQUENCY
California	Redding	KVIP-TV (Formerly KVIP)	7	174-180
Illinois	Peoria	WMBD-TV	31	572-578
Oklahoma	Tulsa	KTUL-TV (Formerly KTVX)	8	180-186
Nebraska	North Platte	KWSL	2	54-60
Pennsylvania	McKeesport	WTAE	6	82-88
Texas	Amarillo	KVII	7	174-180
Texas	Monahans	KVKM-TV	9	186-192
Washington	Kennewick	KTRX	25	536-542

* ERP = (effective radiated power, kw.)

GREATEST ADVANCE IN SHOP-METHOD HOME TRAINING

EARN MORE MONEY... GET INTO TELEVISION ELECTRONICS–RADIO

Learn ALL 8 PHASES in ONE MODERN HOME-STUDY COURSE
At Home — In Spare Time

YOU GET ALL THIS NEWEST PRACTICAL EQUIPMENT

- Parts to build a modern TV set, including all tubes plus a large screen Picture Tube
- Parts to build a powerful Superhet Receiver, standard broadcast and short wave
- Parts to conduct many experiments and build Continuity Checker, RF Ocillator, TV Circuits, Audio Oscillator, TRF Receiver, Signal Generator
- A Valuable Professional Multitester

YOUR NATIONAL SCHOOLS TELERAMA COURSE COVERS ALL 8 PHASES

1. TELEVISION, INCLUDING COLOR TV
2. RADIO, FM AND AM
3. INDUSTRIAL ELECTRONICS
4. SOUND RECORDING AND HI FIDELITY
5. PREPARATION FOR FCC LICENSE
6. AUTOMATION
7. RADAR AND MICRO WAVES
8. COMMUNICATIONS

YOU ARE NEEDED IN THE TELEVISION-ELECTRONICS-RADIO INDUSTRY! You can build a secure future for yourself if you get into Electronics NOW! Today's shortage of trained technicians creates tremendous opportunities. National Schools Shop-Method trained technicians are in constant and growing demand for high-pay jobs in Broadcasting and Communications, Electronic Research, Servicing and Repair, and many other branches.

Let National Schools, a Resident Technical School for over 50 years train you for today's unlimited opportunities in electronics! Our Shop Method trains you to be a MASTER-TECHNICIAN. Completely up to date, developed by experienced instructors and engineers, your Telerama Course will teach you all phases of the industry quickly, clearly and correctly. You can master the most modern projects, such as Color TV, printed circuits — even prepare for FCC License without taking a special course. You can handle sales, servicing, manufacturing, or make good money in your own business. SEND FOR FACTS TODAY!

EARN AS YOU LEARN. Many of our students earn their entire tuition and more in Spare Time jobs we show them how to do while learning.

YOU GET EVERYTHING YOU NEED — Clear, profusely illustrated lessons, shop-tested manuals, modern circuit diagrams, practical job projects — all the valuable equipment shown above — many other materials and services — consultation privilege with our qualified staff, and Graduate Employment Service. EVERYTHING YOU NEED for outstanding success in Electronics.

RESIDENT TRAINING AT LOS ANGELES

If you wish to take your training in our Resident School at Los Angeles, the world's TV capital, start NOW in our big, modern Shops, Labs and Radio-TV Studios. Here you work with latest Electronic equipment—professionally installed—finest, most complete facilities offered by any school. Expert, friendly instructors. Personal attention. Graduate Employment Service. Help in finding home near school—and part time job while you learn. Check box in coupon for full information.

MEMBER
NATIONAL HOME STUDY COUNCIL
NATIONAL COUNCIL OF TECHNICAL SCHOOLS 1944

FREE! Fully illustrated "Career" Book in TV-Radio-Electronics. PLUS actual sample lesson—yours at no cost, no obligation. CLIP COUPON NOW . . . MAIL IT TODAY!

APPROVED FOR G.I. TRAINING

NATIONAL SCHOOLS

4000 S. FIGUEROA ST., LOS ANGELES 37, CALIF.

NATIONAL SCHOOLS

TECHNICAL TRADE TRAINING SINCE 1905
LOS ANGELES 37, CALIFORNIA

GET FAST SERVICE—MAIL NOW TO
NATIONAL SCHOOLS, DEPT. RH-127
4000 S. FIGUEROA ST.
LOS ANGELES 37, CALIF.

Rush free TV-Radio "Opportunity" Book and sample lesson. No salesman will call.

NAME _____ AGE _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____
☐ Check if interested ONLY in Resident School training at Los Angeles.
VETERANS: Give date of Discharge _____

YOUR INSTALLATION VOLUME CAN BE GREATER!

NO FINGERNAIL FUMBLING!

FLUXVALVE SINGLE SERIES 370—A miniature high quality cartridge for use in any type of auto-changer or manual player arm. Available in 5 models, prices start at a low $17.85.

FLUXVALVE TWIN SERIES 350—A turnover cartridge providing a rapid change of stylus point radius. Available in 12 models featuring many combinations of styli, prices start at a modest $24.

Model 194D UNIPOISE Pickup Arm—This new . . . lightweight . . . integrated arm and cartridge assembly containing the FLUXVALVE with exclusive "T-Guard" stylus—is only a fraction of the weight of conventional tone arms. High compliance and single friction-free pivot bearing assure distortionless tracking of microgroove and standard groove recordings. Available with the ½, 1 or 2.7 mil diamond stylus. Prices from $59.85.

Exclusive

"T-GUARD" STYLUS

only with the

fluxvalve

PICKERING'S introduction of the *truly* miniature FLUXVALVE magnetic phonograph cartridge represents a new era in high fidelity cartridge design. This newest of PICKERING cartridges brings the music lover the most exciting and *safest* idea in a stylus assembly since PICKERING introduced the first lightweight high fidelity pickup more than a decade ago.

The "T-Guard" stylus assembly is a quick-change, easy to slip-in unit which eliminates precarious finger-nail fumbling. Its practical "T" shape provides a firm and comfortable grip for safe and easy stylus change.

The most flexible cartridge in the world . . . the FLUXVALVE is the *only* cartridge with the remarkable ½ mil stylus . . . exclusive *only* with PICKERING. The FLUXVALVE can be used with any one of *five* styli, to meet any requirement or application . . . to play any record, at any speed.

If you are planning to buy a new cartridge—the fact that PICKERING developed this revolutionary stylus is *important to you!* All of the research, development and planning that went into the "T-Guard" stylus is conclusive proof of the superlative engineering skill in every FLUXVALVE model you buy.

"For those who can hear the difference" FINE QUALITY HIGH FIDELITY PRODUCTS BY

PICKERING & COMPANY, INC., Plainview, N. Y.

the matter should still be brought before the Congress.

The Senator said that he . . . "was opposed to any form of subscription TV that will cancel without recourse the Federal Government's laws and regulations that TV would be free."

He added that if . . . "there is to be a system of TV for which people will pay, then its priority is second to that of free TV, as long as the government has anything to do with allocations. . . ."

Noting that we should first resolve the problem of channel utilization before considering any other programs, he added that we must not . . . "embark upon another experiment that will only complicate a situation already approaching chaos."

REVOLUTIONARY DOPPLER RADAR

self-contained aircraft navigation systems, which can plot a course anywhere on the globe, compute the speed and drift of the airplane, compute continuously the distance to destination and signal when the destination has been reached, have been developed for the Air Force, the Department of Defense disclosed a few weeks ago.

The new system is based on a principle discovered in 1842 by an Austrian physicist, Christian Doppler. He found that sound from a moving object has a higher pitch as it approaches a stationary bystander than it has when receding. Subsequently, it was learned that the same is true of radio waves. In 1938, the Naval Research Laboratory demonstrated that the Doppler principle could be applied to electromagnetic waves. W. J. Tull and J. J. Hibbert, at Massachusetts Institute of Technology's Radiation Laboratory, proposed that it be used to determine the velocity of an aircraft for navigational purposes.

A project was initiated in 1945 at the Communication and Navigation Laboratory of the Wright Air Development Center, where a small group from the Navigation branch began a study of the problem with members of industry. These engineers proved the technical feasibility of Doppler radar in 1946 by mounting a hand-built set on a truck and driving the truck around the Wright-Patterson Air Force Base. The next set, also hand built, was the "Janus-1," named after the Roman god that faces both ways, because it used forward and backward angled radar beams. This was flown in a B-29 in 1948.

Most of these men participated in Polar, Atlantic, and Caribbean study flights. In July, 1955, the Self-Contained Navigation Branch, as it was then named, was transferred from the Communication and Navigation Laboratory to the Weapons Guidance Laboratory and was named the Navigation Branch.

In the Doppler-radar system, signals are beamed to the true ground where, back-scatter, or echoes, return to the airplane and are picked up by a receiver. The difference in frequencies

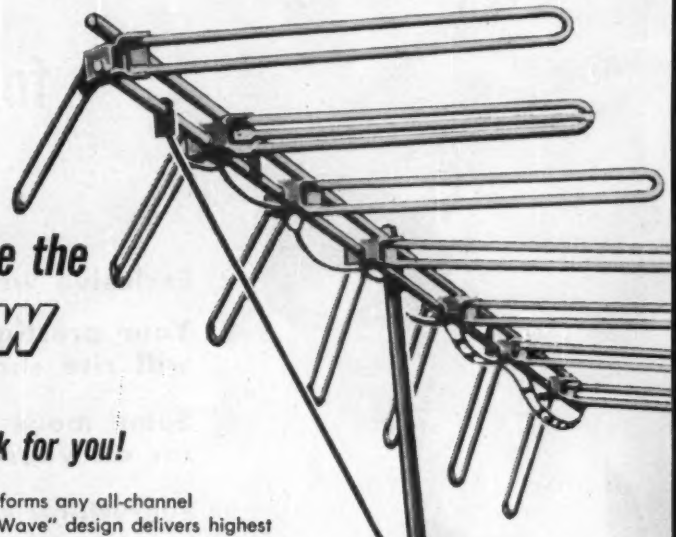
(*Continued on page* 138)

YOUR INSTALLATION VOLUME CAN BE GREATER!

If you're *not* a Channel Master Dealer you are probably not getting your share of the *really profitable* antenna installation business. Hundreds of dealers have doubled and even tripled their antenna sales *in less than one year* when they switched to Channel Master and featured the famous T-W antenna. In fact, far more T-W antennas are bought than any other fringe area antenna. There must be good reasons for this. Below are listed but a few of them.

How much installation business are you losing every week?

...because you don't feature the CHANNEL MASTER® T-W



7-element model no. 350
5-element model no. 351
3-element model no. 352

Put these extra selling advantages to work for you!

Superior PERFORMANCE! Outperforms any all-channel antenna ever made! Revolutionary "Traveling Wave" design delivers highest front-to-back ratios (better than 10:1) — top gain over the entire VHF range.

Stronger CONSTRUCTION! Super-strong in every detail of construction: Twin-Boom— the only antenna with 2 full length crossarms; 2 Super-Nests — the most powerful grip that ever held an antenna to the mast; Line-Lok — absorbs all transmission line tension; 7/16" dia. elements.

Bigger NATIONAL ADVERTISING! More than 75,000,000 advertising messages in America's leading national magazines. Now saturation coverage with big-space ads blanketing 173 prime outdoor antenna markets.

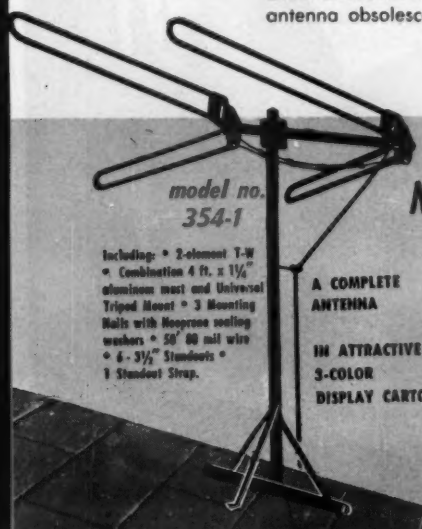
LIVE LEADS galore! Tens of thousands have already responded to Channel Master's Free "Antenna Check-Up Kit" offer — **repeated** in new national ads. Based on experience, 50% — and more — of these leads are converted into actual sales.

Local CO-OP ADVERTISING! The most liberal advertising allowance in the industry — so you can run your own local promotions. Channel Master dealers have the widest array of mats, radio and TV spots, and display materials.

Promoting ANTENNA REPLACEMENTS! Channel Master's national advertising hammers home the theme of antenna obsolescence — opening new markets for you!

Call your Channel Master distributor now!

® Reg. U.S. Pat. Office and Canada



model no. 354-1

Including: • 2-element T-W • Combination 4 ft. x 1¼" aluminum mast and Universal Tripod Mount • 3 Mounting Nails with Neoprene sealing washers • 50' 80 mil wire • 6 - 3½" Standoffs • 1 Standout Strap.

A COMPLETE ANTENNA

IN ATTRACTIVE 3-COLOR DISPLAY CARTON

NEW "INSTALL-IT-YOURSELF" ANTENNA KIT

featuring new 2 ELEMENT T-W ANTENNA

Designed for top performance in suburban and metropolitan areas. Powerful "Traveling Wave" principle provides the 2-element T-W with better all around performance than a stacked conical.

***Promotionally Priced at* $29.95 list**

CHANNEL MASTER CORP.

ELLENVILLE, N. Y.

Copyright 1957 Channel Master Corp.

WORLD'S LARGEST MANUFACTURER OF TV ANTENNAS AND ACCESSORIES

NOW! MATCHED TV FROM GENERAL

for that smart, efficient,

- Exclusive with General Electric tube dealers!
- Your prestige with customers will rise sharply.
- Same modern two-tone styling for all your equipment.
- Everything conveniently at hand for television repairs.
- Expertly organized to save your working time.
- Be first with the newest in home-service equipment!

CLASSICS OF SCIENCE

"Should be read by everyone

SERVICE CASES ELECTRIC--

professional look

SERVICE TOOL CASE. 16" by 8" by 6 3/16". Weighs 5 1/2 lbs. without contents.

SPECIAL "160". Holds over 160 tubes. 17 7/8" by 8 3/8" by 11 7/16". 8 lbs. without contents.

SERVICE MASTER "240". Holds over 240 tubes. 22 1/8" by 9 9/16" by 12 3/4". 9 1/2 lbs. when empty.

These new matched service cases are a G-E "first". You can get them nowhere else. They are built just as strongly as their smart appearance indicates . . . with rugged construction, heavy-duty hardware, craftsmanship in every detail. And planned by service experts! You carry with you—compactly—everything you need for home service calls.

The cases are fully matched in design and in their attractive orange-and-gray colors. The leatherette-type finish is scuff-resistant for plenty of hard wear. You will be proud to carry these handsome cases into the finest home. Their smart, up-to-the-minute appearance stands for the quality television service you offer.

Waiting for you . . . now . . . is your set of matched service cases. Your General Electric tube distributor will tell you how to obtain them. Phone him! *Distributor Sales, Electronic Components Division, General Electric Co., Owensboro, Ky.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

161-1A22

CLASSICS OF SCIENCE

S205. OPTICKS, Sir Isaac Newton. Easily followed account of experiments with light, optical apparatus; theories of light, Preface by Einstein. 7 pp. of portraits, etc. 510 pp. Paperbd. $2.00

S8. WORKS OF ARCHIMEDES. All known works in English of greatest mathematician of antiquity. 183-page study of Greek math included. Edited by Sir Thomas Heath. 563 pp. Paperbd. $2.00

S89. DIALOGUES CONCERNING TWO NEW SCIENCES, Galileo. Mechanics, dynamics, elasticity, etc., discussed in easily followed semifictional form. 126 diagrams. 300 pp. Paperbd. $1.65

T203. ANIMALS IN MOTION, Eadweard Muybridge. Largest collection (over 4,000 photos) ever made from famous Muybridge collection of high speed stopped action photos of animals in motion. Horses, cats, lions, guanacos, camels, sloths, elephants, 27 other animals, birds. 123 different types of action. Invaluable for biologists, zoologists, naturalists. New introduction by S. L. Brown, Am. Mus. of Nat. History. Over 410 pp. 7⅞ x 10¾. Deluxe edition. Clothbound $10.00

ENTERTAINMENTS, PUZZLES . . .

T167. THE COMPLETE NONSENSE OF EDWARD LEAR. All original text, illustrations of all nonsense books Lear ever wrote, 5 books in 1. Dong with a Luminous Nose, Owl & Pussycat—hundreds of others. 546 illustrations. 320 pp. Paperbound $1.00

T1. FLATLAND, E. A. Abbott. Fictionalized life in 2 dimensions, offers techniques for visualizing multidimensional forms, etc. Clearer than most texts. "Delightful." SCIENCE NEWS LETTER. 128 pp. Paperbound $1.00

T97. CRYPTANALYSIS, H. F. Gaines. Best intermediate text for serious student; modern techniques, much not usually known except to experts. 236 pp. Paperbd. $2.00

T362. LEARN CHESS FROM THE MASTERS, F. Reinfeld. Play 10 games against masters and grade every move you make! 152 pp. Paperbound $1.00

T162. MATHEMATICAL RECREATIONS, M. Kraitchik. Moderately advanced problems based on theory of numbers, topology, etc. Unequalled for easily assimilated insights. 330 pp. Paperbound $1.75

T330. MATHEMATICAL EXCURSIONS, H. Merrill. 90 puzzles: techniques not taught in schools; dyadic systems, factoring at sight, etc. 145 pp. Paperbd. $1.00

T386. MORPHY'S GAMES OF CHESS. 300 games by Paul Morphy, greatest chess player of all time. Put aggressiveness into your game from them. 235 diagrams. 362 pp. Paperbd. $1.75

T417. REINFELD ON THE ENDGAME IN CHESS, F. Reinfeld. Extremely easily followed presentation, stresses enormous range of wrong play, telling exactly what is wrong. Recommended. 183 pp. Paperbound $1.25

T337. PUZZLE QUIZ STUNT FUN, Jerome Meyer. Mathematical puzzles, deductions, observations, etc. 238 in all. Entirely new. 256 pp. Paperbound $1.00

T344. NEW WORLD PUZZLES, G. L. Kaufman. 100 entirely new puzzles for enthusiasts of word games: chesswords, designonyms, addle letter anagrams, lapwords, acrostigrams, etc. 196 figures. 128 pp. Paperbd. $1.00

T116. MATHEMAGIC, MAGIC PUZZLES, GAMES WITH NUMBERS, R. V. Heath. One of the most famous books in recreational math. 128 pp. Paperbd. $1.00

T304. HOUDINI ON MAGIC. Houdini's own account of magic tricks, picking locks, exposes of spiritualism, how stage magic works, etc. Incredible feats of greatest magician of modern times. 155 photos. 295 pp. Paperbd. $1.00

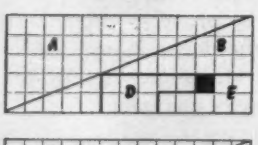
T198. MATHEMATICAL PUZZLES FOR BEGINNERS AND ENTHUSIASTS, G. Mott-Smith. 188 mathematical puzzles of most delightful sort, detailed solutions. 248 pp. Paperbd. $1.00

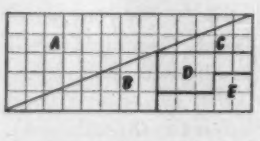
T143. BOOK OF MODERN PUZZLES, G. L. Kaufman. More than 150 word and logic puzzles, unusual types, highly original; no old chestnuts. 192 pp. Paperbd. $1.00

T264. 7 SCIENCE FICTION NOVELS, H. G. Wells. Time Machine, Island of Dr. Moreau, 1st Men in Moon, Invisible Man, War of Worlds, etc. Full texts. 105 pp. Clothbound $3.95

T265. 28 SCIENCE FICTION STORIES, H. G. Wells. 2 novels (Men Like Gods, Star Begotten), plus 26 of best short stories: Empire of Ants, Crystal Egg, Man Who Could Work Miracles, etc. 915 pp. Clothbound $3.95

Can you explain this?





If you rearrange the parts of the top figure into the bottom one, you lose one square of area. You'll find out why in

T335. MATHEMATICS, MAGIC AND MYSTERY, Martin Gardner. This book explains the math behind magic, in terms of probability, topology, number theory, etc. How a Curry square shows that the sum of parts can be greater than whole; how Sam Loyd could make a Chinaman vanish, etc. Scores of puzzling phenomena, tricks you can perform. 135 illustrations. 186 pp. Paperbd. $1.00

"Should be read by everyone, scientist and non-scientist alike,"

R. T. Birge, Former President, AMERICAN PHYSICAL SOCIETY.

FADS & FALLACIES IN THE NAME OF SCIENCE

by Martin Gardner $1.50

Atlantis . . . Wilhelm Reich and orgone energy . . . L. Ron Hubbard and dianetics . . . Korzybski and General Semantics . . . Bridey Murphy . . . psionics machines . . . Velikovsky . . . Lysenko . . . flying saucers and little green men . . . ESP and Dr. Rhine . . . The Bates Method . . . hollow earth fanatics . . . medical fads and fallacies . . . dozens of others.

"Just about the most stimulating science book of the year," GALAXY. "Every scientist, for the preservation of his own good sense, should read this book," QUARTERLY REVIEW OF BIOLOGY. "Could be read with profit by almost anyone," MAG. OF PHILOSOPHY. "Hilariously entertaining," SAN FRANCISCO CHRONICLE.

This is the standard work exposing the various cults, fallacies and panaceas which have masqueraded as science. Ranging from astronomy to zoology, covering physics, philosophy, medicine and other sciences, it is not a collection of anecdotes, but a fair, reasoned account of eccentric theory and its implications.

T394. FADS AND FALLACIES is an intensely useful book. Used by science, philosophy, and psychology courses all over the country as required reading, it will serve as an excellent innoculation for you and your friends against cleverly constructed crackpot theory and practice. Give it to friends who ask questions about flying saucers or dianetics. Read it for an evening or two of entertainment and amazement. Learn why the spread of scientific fad and fallacy is such a large industry at present. 365 pp. 5⅜ x 8. Paperbd. $1.50

S292-3. THEORY OF SOUNDS, Lord Rayleigh. Solutions for vibrating systems, hints on non-linears. Harmonic functions, theory of resonators, etc. Formerly $12. Total 1041 pp. 2 vol. set. The set, Paperbound $4.00

T187. THE PSYCHOLOGY OF INVENTION IN THE MATHEMATICAL FIELD, J. Hadamard. Where ideas come from, what role the unconscious plays, how Einstein, Poincaré, others developed new ideas. 158 pp. Paperbd. $1.25

T10. LANGUAGE, TRUTH AND LOGIC, A. Ayer. Clear intro. to logical positivism. "I should like to have written it myself," BERTRAND RUSSELL. 160 pp. Paperbd. $1.25

S27. NON-EUCLIDEAN GEOMETRY, R. Bonola. Standard coverage, history, exposition, with complete texts of Bolyai & Lobachevski included. 180 diagrams. 431 pp. Paperbd. $1.95

S182. GEOMETRY OF 4 DIMENSIONS, H. P. Manning. Unique in English as simple, clear easily followed account. 76 figures. 357 pp. Paperbd. $1.95

T418. SPINNING TOPS AND GYROSCOPIC MOTION, K. J. Perry. Classic popular exposition of precession, axes of rotating body, etc. Physics, astronomy, etc. 62 figures, 128 pp. Paperbd. $1.00

S377. FOUNDATIONS OF PHYSICS, R. Lindsay, H. Margenau. 1st-rate coverage of ideas and methodology of theoretical physics. Theory, logic of science, role of experiment, etc. Not a text; not elementary. "Unreservedly recommended," NATURE. 35 illustrations. 577 pp. Paperbd. $2.45

BEST INEXPENSIVE LANGUAGE RECORD COURSE ON THE MARKET!

Here is the only language record set planned to help you in foreign travel. Giving practical language in a form you can use immediately, it will fill hundreds of your travel needs. Check these features. (1) Modern, no trivia, no technicalities. (2) 800 foreign sentences, 1½ hours recording. (3) English and foreign language recorded, with pause for you to repeat. (4) 128-page manual, with complete text, only fully indexed set on the market. (5) High fidelity recording. GUARANTEED. Return it within 10 days if you don't like it. Wonderful review, refresher, supplement for any course. In each set you get 3 10" 33⅓ records, manual, album.

T675. LISTEN & LEARN FRENCH, per set, $4.95
T676. LISTEN & LEARN SPANISH, per set, $4.95
T677. LISTEN & LEARN GERMAN, per set, $4.95
T678. LISTEN & LEARN ITALIAN, per set, $4.95

S366. APPLIED OPTICS AND OPTICAL DESIGN, A. Conrady. Full unabridged reissue. "As a practical guide this has no rival," TRANS. OPTICAL SOCIETY. 150 illustrations. 528 pp. Paperbd. $2.95

T295. HOW TO CALCULATE QUICKLY, H. Sticker. Tried, true method, over 9,000 problems to develop your number sense; techniques not taught in schools, division, multiplication, etc. 256 pp. Paperbd. $1.00

S169. VECTOR AND TENSOR ANALYSIS, G. E. Hay. Start with simple definitions, finish understanding vectors and tensors. 201 pp. Paperbd. $1.75

S164. INTRO. TO SYMBOLIC LOGIC, Susanne Langer. Even if you never finished high school algebra you can learn modern Russell-Whitehead logic. 368 pp. Paperbd. $1.75

T440. MATHEMATICS IN ACTION, O. G. Sutton. Invaluable bridge between pure math and applied. The author first presents a lucid account of vectors, non-Euclidean geometry, integration, differential equations, and other topics of math, then shows their application to ballistics, computing machines, waves, electrons, aeronautics, meteorology, statistics, etc. No math beyond elementary calculus necessary; a reader with no college math can understand most of this book. 2nd ed. 86 figures. 244 pp. Clothbd. $3.50

T31. CONCERNING THE NATURE OF THINGS, W. Bragg. Nobel Laureate in easily followed account of gases, crystals, etc. 32 pp. of photos. 246 pp. Paperbd. $1.35

T196. NATURE OF LIGHT & COLOUR IN THE OPEN AIR, M. Minnaert. Mirages, black snow, the green ray—other phenomena; hundreds of observation projects. 378 pp. Paperbd. $1.85

T61. COMMON SENSE OF THE EXACT SCIENCES, W. Clifford. For 70 years a classical guide to scientific mathematical thought. Recommended by Bertrand Russell. 249 pp. Paperbd. $1.60

S79. HISTORY OF ASTRONOMY FROM THALES TO KEPLER, J. Dreyer. Only thorough history in English, details on fascinating premodern systems. 447 pp. Paperbd. $1.98

S255. CONCISE HISTORY OF MATHEMATICS, D. Struik. No math needed to follow this lucid study of idea development from Greeks to moderns. 66 illustrations. 318 pp. Paperbd. $1.75

S193. HIGHER MATH. FOR STUDENTS OF CHEMISTRY & PHYSICS, J. Mellor. Unequalled practical presentation based on lab situations: integral, differential calculus, etc. 663 pp. Paperbd. $2.00

T213. THE ORIGIN OF LIFE, A. Oparin. Classic 1st modern statement of evolution of life from nitrocarbon compounds. 295 pp. Paperbd. $1.75

T370. CALCULUS REFRESHER FOR TECHNICAL MEN, A. Klaf. Only detailed brush-up; easy way to sure knowledge, in questions and answers. 566 problems, also; answers to odd ones. 436 pp. Paperbd. $2.00

S289. MONOGRAPHS ON TOPICS OF MODERN MATHEMATICS, ed. J. W. Young. Foundations of geometry, non-Euclidean geometry, theory of numbers, calculus, for persons who have forgotten or never finished elementary college math. 432 pp. Paperbd. $2.00

S411. VELOCITY-MODULATED THERMIONIC TUBES, A. H. W. Beck. Edited by J. A. Ratcliffe. Intro. to fundamentals, still valuable because it deals with principles. Intelligible to anyone with reasonable background in pre-1939 radio. Covers resonant cavities, heavy current electron beams, but stress on field and beam, and application. 54 illustrations, 190 pp. Clothbound $1.25

All books standard 5⅜x8 unless otherwise indicated.

Dept. 129, Dover Publications, Inc.
920 Broadway, N. Y. 10, N. Y.

Please send me the books circled below (please print).

Name .....

Address .....

City .....Zone....State.....

I am enclosing $.....in full payment. (Payment in full must accompany all orders except from libraries or public institutions who may be billed.) Please add 10¢ per book for postage and shipping charges on orders less than $5. Dover pays postage on orders of $5 or more.

T1	S89	S182	T264	T330	S411
S9	T107	S193	T265	T362	T416
T10	S109	T196	S269	S366	T417
S27	T110	T198	T292-3	T370	T440
T31	T143	S203	T295	S377	T675
T61	T162	S205	T335	T384	T676
S79	S164	T213	T337	T386	T677
T97	T167	S255	T344	T394	T678

SATISFACTION GUARANTEED. All books and records returnable within 10 days for full and immediate cash refund if they are unsatisfactory in any respect whatsoever.

The "GEM" of them all-- ROHN

TOWERS

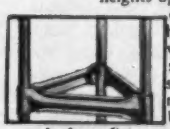
Rohn Towers are the only *complete line* of towers . . . from the No. 6 "all purpose" tower which is most suitable for TV installations, to the giant No. 40 communications tower. Hot-dipped galvanized finish is featured in the entire line.

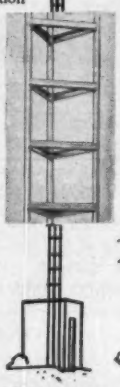
No. 6 Tower is ideal for heights 50-120'. Features Magic Triangle construction that assures great strength, stability and durability. Stocking Rohn No. 6 Towers means you can fulfill practically all tower needs!

No. 40 Communications Tower for extreme heights and heavy duty work. Uses large 18" equilateral triangular design which allows heights up to 300 ft. or lesser heights where considerable strength is needed. Used widely for radio communication and micro wave throughout U. S. Sell this tower for these requirements existing in your locality.

Both the No. 6 and No. 40 Towers are in 10' sections and are easily installed without special equipment.

Also available: No. 30 Towers and a unique space-saver PACKAGED TOWER, the latter available in heights from 24' to 64'.





NEW BASE

"Same day" installation base available NOW for No. 6 and P. T. Tower! Use this unique base that permits "on the spot" erection and "on the ground" assembly. Towers are then merely "walked up" into position.

ROHN "superior design" LINE

Telescoping MASTS

Heavy-duty hot-dipped galvanized steel tubing and rigid joints give extraordinary strength. Quick installation . . . mast attached to base—antenna fixed, then mast hoisted quickly to desired height. Utilizes special clamp and guy ring arrangement. Flanged interior section; crimped exterior section gives you a mast that won't pull apart with unequalled stability. Complete with guy rings and necessary erection parts. In 20, 30, 40 and 50 ft. sizes. Bases and ground mounts available.

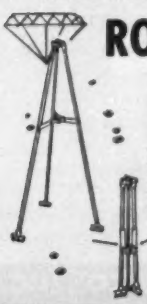
TUBING

True hot-dipped galvanized tubing coating both inside and out. Machined to perfection . . . available with 6" expanded end or plain—and in either 5' or 10' lengths. Painted if desired also available.

ACCESSORIES

A full line of accessories are available—all—Hot Dipped Galvanizing! Some of the items are: rotor posts, house brackets, eave brackets, peak and flat roof mounts, instant drive-in bases, hinged base sections, telescoping mast bases, guying brackets, UHF antenna mounts, erection fixtures, and a variety of mounts and supports for masts or tubing.

ROOF TOWERS



5 "Superior Design" roof towers in heights from 2½' to 10'. Most all models are collapsible for easy shipping and storage. All models ideal answer for quick, inexpensive roof top installation. Get full information on this fine line of roof towers.

ROHN offers these exclusives

- Hot-dipped galvanizing
- unequalled design and engineering
- mass production for low cost
- universal customer acceptance
- pioneer manufacturers
- complete line.

SEND COUPON TODAY!

"World's Largest Exclusive Manufacturer of TV-Communications Towers"

ROHN *Manufacturing Co.*

116 LIMESTONE, BELLEVUE

PEORIA, ILLINOIS PHONE 4-9156

GET COMPLETE DETAILS AND CATALOG NOW

Rohn Mfg. Co., 116 Limestone, Bellevue Peoria, Ill.

Gentlemen: Please rush me complete details on the full line of Rohn Towers and Accessories.

FIRM_____

NAME_____ TITLE_____

ADDRESS_____

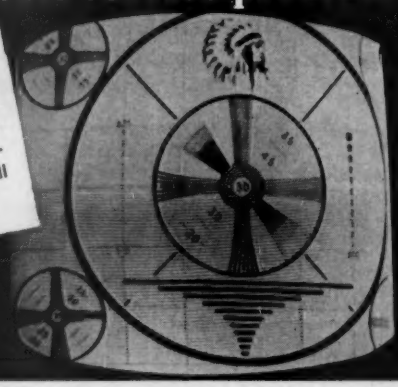
CITY_____ STATE_____

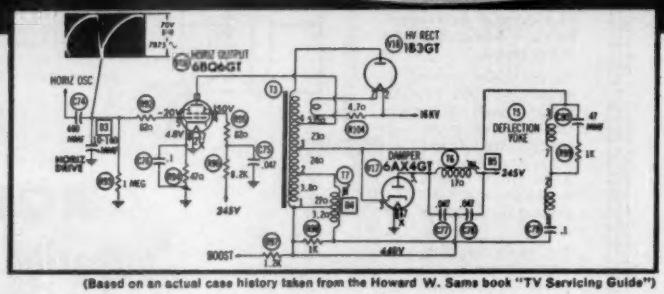
how long would it take you to solve this service problem?

PHOTOFACT

helps you lick problems like this in just minutes for only *2½¢ per model!

SYMPTOM: Horizontal Foldover affecting the right side of the screen, accompanied by an overall reduction in width





(Based on an actual case history taken from the Howard W. Sams book "TV Servicing Guide")

Let's look at this problem: When the foldover occurs at the right side of the picture, the trouble usually originates in the horizontal discharge or output circuits. Look for the following possible causes:

1. Defective tube in the flyback circuit
2. Leaky coupling capacitor (C74)
3. Misadjusted or defective drive control
4. Open or leaky capacitor (C76) in the cathode of the output stage
5. Incorrect value of the grid resistor (R93) in the horizontal output stage
6. Open or leaky screen bypass capacitor (C75) in the output stage
7. Incorrect value of the cathode resistor (R94) in horizontal output stage
8. Incorrect value of the screen resistor (R96) in horizontal output stage
9. Defective yoke or flyback transformer

With the applicable PHOTOFACT Folder at your fingertips, you'll trouble-shoot and solve this problem in just seconds. Here's-how:

Using the Tube Placement Chart (you'll find it in every PHOTOFACT TV Folder), you'll quickly locate and check the tubes in the Flyback Circuit. Tubes okay?—then: A waveform analysis of the signal in the sweep section is perhaps the quickest procedure you can use to localize the trouble. Check the waveform at the junction of the two capacitors, B3 and C74. The correct waveform and peak-to-peak voltages are shown right on the PHOTOFACT Standard Notation Schematic. Waveform incorrect?—Then, using the easy-to-read resistance chart and the correct voltages shown on the schematic, check for proper resistance and voltage values to determine which part is defective. The exclusive PHOTOFACT chassis photos with "call-outs" keyed to the schematic help you locate the faulty part quickly. Important! Horizontal Foldover may result from improperly matched components in this circuit. It is *imperative* that all parts replaced duplicate the originals. You'll find the proper replacement parts for all components listed in the complete PHOTOFACT parts list.

Remember, whatever the trouble may be, you'll locate it faster and solve it easier and more profitably with a PHOTOFACT Folder by your side.

Use the servicing method you prefer—checking of waveform, voltage or resistance—you'll find all the information you need at your finger-tips in PHOTOFACT. For only *2½¢ per model, PHOTOFACT helps you solve your service problems in just minutes—helps you service more sets and earn more daily!

*Based on the average number of models covered in a single set of PHOTOFACT Folders.

MONEY BACK GUARANTEE!

Got a tough repair? Try this—at Howard W. Sams' own risk: see your Parts Distributor and buy the proper PHOTOFACT Folder Set covering the receiver. Then use it on the actual repair. If PHOTOFACT doesn't save you time, doesn't make the job easier and more profitable for you, Howard W. Sams wants you to return the complete Folder Set direct to him and he'll refund your purchase price promptly. GET THE PROOF FOR YOURSELF—TRY PHOTOFACT NOW!

FREE

FOR SERVICE TECHNICIANS ONLY

Fill out and mail coupon today for Free subscription to the Sams Photofact Index—your up-to-date guide to virtually any receiver model ever to come into your shop. Send coupon now.

HOWARD W. SAMS & CO., INC.

Howard W. Sams & Co., Inc.
2203 E. 46th St., Indianapolis 5, Ind.

☐ Put me on your mailing list to receive the Sams Photofact Index and Supplements. My (letterhead) (business card) is attached.

☐ I'm a Service Technician: ☐ full time; ☐ part time

My Distributor is:_____

Shop Name_____

Attn:_____

Address:_____

City_____ Zone____ State_____

Electronics Boom Seen

Need For Television Technicians To Rise

Industry Warned About Shortage Of Trained Men

TV SALES SET NEW RECORD

Sylvania Head Expects Huge Electronic Gains

Transistor Radios Developed

RCA HEAD PREDICTS SALES BOOM FOR COLOR TV SETS

VETERANS - - NON-VETERANS

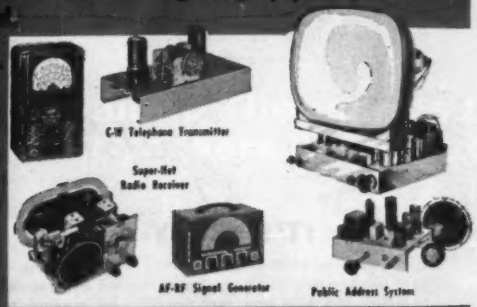
Get Into The Field That's Making Headlines

All over the nation the Television-Radio-Electronics industry is making News — News that means opportunity for YOU. You can cash in on the headlines.

I WILL TRAIN YOU AT HOME FOR A TOP-PAY JOB IN TELEVISION

I will prepare you for a spot in America's fastest-growing industry. You can become a trained technician in your spare time without giving up your present job or social life. No experience needed.

LEARN BY DOING



As part of your training I give you the equipment you need to set up your own home laboratory and prepare for a top-pay job or set up your own business. You build and keep a TELEVISION RECEIVER designed and engineered to take any size picture tube up to 21-inch. (10-inch tube furnished. Slight extra cost for larger sizes.) . . . also a Super-Het Radio Receiver, AF-RF Signal Generator, Combination Voltmeter-Ammeter-Ohmmeter, C-W Telephone Transmitter, Public Address System, AC-DC Power Supply. Everything supplied, including all tubes.

STUDY NEWEST DEVELOPMENTS

My training covers all the latest developments in the fast-growing Television-Radio-Electronics industry. You learn about FM — RADAR — COLOR TV — TRANSISTORS — PRINTED CIRCUITS, etc.

CHOOSE FROM FOUR COMPLETE COURSES
covering all phases of Radio, FM and TV

- Radio, FM and Television Technician Course—no previous experience needed.
- FM-TV Technician Course—previous training or experience in radio required.
- TV Studio Technician Course—advanced course for trained men.
- Color TV Technician Course—includes latest color TV circuits.

EXTRA TRAINING IN NEW YORK CITY AT NO EXTRA COST!

After you finish your home study training in Course 1 or 2 you can have two weeks, 50 hours, of intensive Lab work on modern electronic equipment at our associate resident school, Pierce School of Radio & Television. THIS EXTRA TRAINING IS YOURS AT NO EXTRA COST WHATSOEVER!

FCC COACHING COURSE

Important for BETTER-PAY JOBS requiring FCC License! You get this training AT NO EXTRA COST! Top TV jobs go to FCC-licensed technicians.

VETERANS

My School fully approved to train Veterans under new Korean G. I. Bill. Don't lose your school benefits by waiting too long. Write discharge date on coupon.

Radio-Television Training Association

52 EAST 19th STREET • NEW YORK 3, N. Y.

Licensed by the State of New York • Approved for Veteran Training

Sylvania Now Sponsoring RTTA's Color TV Technician Course

One of the nation's largest electronics manufacturers and marketers, Sylvania Electric Products, Inc., in its continuing effort to cooperate with independent service dealers is now sponsoring the RTTA Color Television Technician Course.

The Color Television Technician Course is being made available to authorized Sylvania Dealers throughout the 48 states who are interested in expanding their knowledge and experience in Color TV servicing.

FREE HOW TO MAKE MONEY IN TV

FREE SAMPLE LESSON

FREE I'll send you my new 40-page book "How to Make Money in Television-Radio-Electronics," a Free sample lesson, and other literature showing how and where you can get a top-pay job in Television.

MAIL THIS COUPON TODAY!

Mr. Leonard C. Lane, President
RTTA
Dept. RT-12D, 52 East 19th Street, New York 3, N.Y.

Dear Mr. Lane: Send me your NEW FREE BOOK, FREE SAMPLE LESSON, and FREE aids that will show me how I can make TOP MONEY IN TELEVISION. I understand I am under no obligation.

(PLEASE PRINT PLAINLY)

Name_____ Age____

Address_____

City_____ Zone____ State____

- ☐ Color TV Tech. Course
- ☐ Radio-FM-TV Technician Course
- ☐ FM-TV Technician Course
- ☐ TV Studio Technician Course

VETERANS! Write discharge date

NO OBLIGATION!

Learn TELEVISION-RADIO

WE TRADE HIGHER!

Howdoody...

Here's a revoltin' SWITCH.....an eevaluator gettin' eevaluated! I'm Jack S., Chief Eevaluator of Trade-Ins at Walter Ashe Radio Co. and the Head-Shrinkers have just figured my Eye-Cue. I don't know why the interest in my eyes.....I got two and see two of everything like anybody else!

They say I'm not a Moron at all....I'm an Imbecile, and I'm really too stupid to be ignorant! This is going to make the boss real happy! He's already pleased with the way I've been losin' money every month in the Trade-In Dept. Now that I'm conscious of how UNCONSCIOUS I really am, I'll mark stuff even crazier and the losses will be phenomenal!

Why don't you sit down and write me a newsy little note about your old gear and throw me into a wild, value setting fit that'll end up with a trade-in price that'll make you as happy as I'm stupid.

You'll love me madly,

Jack S.

IT'S EASY TO DO BUSINESS WITH WALTER ASHE!

1. Just tell us what factory-built gear (made since 1945) you have to trade, and what new gear you wish to purchase. You'll get our top dollar quote by return mail.

2. When the deal is made, you ship your equipment to us by prepaid express or, if express is not available, by prepaid truck. We check it at once and, in most cases, your new gear is on its way to you within 24 hours after we receive your trade-in.

3. We will ship your new gear to you via express in most instances. Where express is not available, or not practical, we will ship by truck.

LOOK! FOUR BRAND NEW MODELS!

GONSET

COMMUNICATOR III
2 or 6 Meters.....$269.50

HAMMARLUND

HAMMARLUND HQ-110.
Less Clock. Net $229.00

JOHNSON

COURIER KIT.....$244.50
Wired & Tested.....289.50

JOHNSON

THUNDERBOLT KIT $450.00
Wired & Tested.....525.00

DO YOU HAVE OUR 1958 CATALOG? ITS FREE!

WRITE FOR FULL DETAILS ABOUT OUR TIME PAYMENT PLAN

All prices f. o. b. St. Louis . Phone CHestnut 1-1125

Walter Ashe RADIO CO.
1125 PINE ST. • ST. LOUIS 1, MO.

WALTER ASHE RADIO COMPANY
1125 Pine Street, St. Louis, Mo.

OUR 36TH YEAR

☐ Rush "Surprise" Trade-In Offer on my.....
for.....
(show make and model number of new equipment desired)

RN-12-57

☐ Send new FREE 1958 Walter Ashe catalog.

Name.....
Address.....
City.....Zone.....State.....

Technical "KNOW-HOW" Can Give You Interesting, Important Work
LEARN-BY-DOING with Kits NRI Sends at No Extra Charge

Learn TELEVISION-RADIO

Servicing or Communications

by Practicing at Home in Spare Time

WITHOUT EXTRA CHARGE you get special NRI kits developed to give actual experience with TV-Radio equipment. You build, test, experiment with receiver or broadcasting circuits. All equipment yours to keep.

NRI Has Trained Thousands for Successful Careers in TV-Radio

Studio Engr., Station KATV
"I am now Studio Engineer at Television Station KATV. Before enrolling for the NRI Course, I was held back by limitation of a sixth grade education." BILLY SANCHEZ, Pine Bluff, Ark.

Has All the Work He Can Do
"Since finishing NRI Course I have repaired more than 2,000 TV and Radio sets a year. NRI training certainly proved to be a good foundation." H. R. GORDON, Milledgeville, Ga.

Has Good Part Time Business
"Quite early in my training I started servicing sets. Now have completely equipped shop. My NRI training is the backbone of my progress." E. A. BREDA, Tacoma, Wash.

Have the High Pay, Prestige, Good Future of a Skilled TV-Radio Technician

People *look up to* and depend on the Technician, more than ever before. Offices, plants, homes everywhere are obliged to buy his knowledge and services. His opportunities are great and are increasing. Become a TV-Radio Technician. At home, and in your spare time, *you* can learn to do this interesting, satisfying work—qualify for important pay. To ambitious men everywhere *here* in the fast growing Television-Radio field is rich promise of fascinating jobs, satisfaction and prestige as well as increasing personal prosperity.

Increased Opportunities in Growing Field

A steady stream of new Electronic products is increasing the job and promotion opportunities for Television-Radio Technicians. Right now, a solid, proven field of opportunity for good pay is servicing the tens of millions of Television and Radio sets now in use. The hundreds of TV and Radio Stations on the air offer interesting jobs for Operators and Technicians.

More Money Soon—Make $10 to $15 a Week Extra Fixing Sets in Spare Time

NRI students find it easy and profitable to start fixing sets for friends and neighbors a few months after enrolling. Picking up $10, $15 and more a week gives substantial extra spending money. Many who start in spare time soon build full time TV-Radio sales and service businesses.

Act Now—See What NRI Can Do for You

NRI has devoted over 40 years to developing simplified practical training methods. You train at home. Get practical experience, learn-by-doing. Address: **NATIONAL RADIO INSTITUTE, Washington 16, D. C.**

The Tested Way To Better Pay

See Other Side

CUT OUT AND MAIL CARD NOW

SAMPLE LESSON AND CATALOG BOTH FREE

NO STAMP NEEDED!
WE PAY POSTAGE

This card entitles you to Actual Lesson on Servicing, shows how you learn Television-Radio at home. You'll also receive 64-Page Catalog.

NATIONAL RADIO INSTITUTE, Dept. A B
Washington 16, D. C.

Please mail me the FREE sample lesson and 64-Page Catalog. (No Salesman will call.)

Name..... Age.....

Address.....

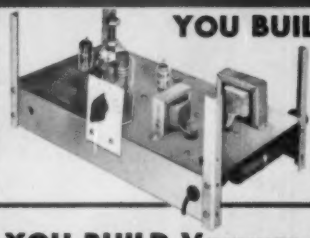
City..... Zone..... State.....

ACCREDITED MEMBER, NATIONAL HOME STUDY COUNCIL

Technical "KNOW-HOW" Can Give You Interesting, Important Work
LEARN-BY-DOING with Kits NRI Sends at No Extra Charge

YOU BUILD AC-DC Superhet Receiver

NRI Servicing Course includes all needed parts. By introducing defects you get actual servicing experience practicing with this modern receiver. Learn-by-doing.



YOU BUILD Signal Generator

You build this Signal Generator. Learn how to compensate high frequency amplifiers, practice aligning typical I.F. amplifiers in receiver circuits. Make tests, conduct experiments.

YOU BUILD Broadcasting Transmitter

As part of NRI Communications Course you build this low power Transmitter, learn commercial broadcasting operators' methods, procedures. Train for your FCC Commercial Operator's License.

YOU BUILD Vacuum Tube Voltmeter

Use it to earn extra cash fixing neighbors' sets; bring to life theory you learn from NRI's easy-to-understand texts.

For Higher Pay, Better Jobs Be a Television-Radio Technician

Servicing Needs More Trained Men

Portable TV, Hi-Fi, Transistor Radios, Color TV are making new demands for trained Technicians. Good opportunities for spare time earnings or a business of your own.

Broadcasting Offers Satisfying Careers

4000 TV and Radio stations offer interesting positions. Govt. Radio, Aviation, Police, Two-Way Communications are growing fields. Trained Radio-TV Operators have a bright future.

J. E. Smith, Founder

Train at Home the NRI Way Famous for Over 40 Years

NRI is America's oldest and largest home study Television-Radio school. The more than 40 years' experience training men for success, the outstanding record and reputation of this school—benefits you in many ways. NRI methods are tested, proven. Successful graduates are everywhere, from coast to coast, in small towns and big cities. You train in your own home, keep your present job while learning. Many successful NRI men did not finish high school. Let us send you an actual lesson, judge for yourself how easy it is to learn.

No Experience Necessary—NRI Sends Many Kits for Practical Experience

You don't have to know anything about electricity or Radio to understand and succeed with NRI Courses. Clearly written, well-illustrated NRI lessons teach TV-Radio-Electronic principles. You get NRI kits for actual experience. All equipment is yours to keep. You learn-by-doing. Mailing the postage-free card may be one of the most important acts of your life. Do it now. Reasonable tuition. Low monthly payments available. Address: NATIONAL RADIO INSTITUTE, Washington 16, D. C.

NRI Graduates Do Important Work

Now Quality Control Chief
"Had no other training in Radio before enrolling, obtained job working on TV amplifiers before finishing course. Now Quality Control Chief." T. R. Favalobo, Norwich, N. Y.

NRI Course Easy to Understand
"I opened my own shop before receiving my diploma. I have had to hire extra help. I am independent in my own business." D. P. Cressey, Stockton, Cal.

Works on Color-TV
"NRI changed my whole life. If I had not taken the course, probably would still be a fireman, struggling along. Now Control Supervisor at WRCA-TV." J. F. Meline, New York, N Y.

FIRST CLASS
Permit No. 20-R
(Sec. 34.9, P. L. & R.)
Washington, D.C.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY

NATIONAL RADIO INSTITUTE

Washington 16, D. C.

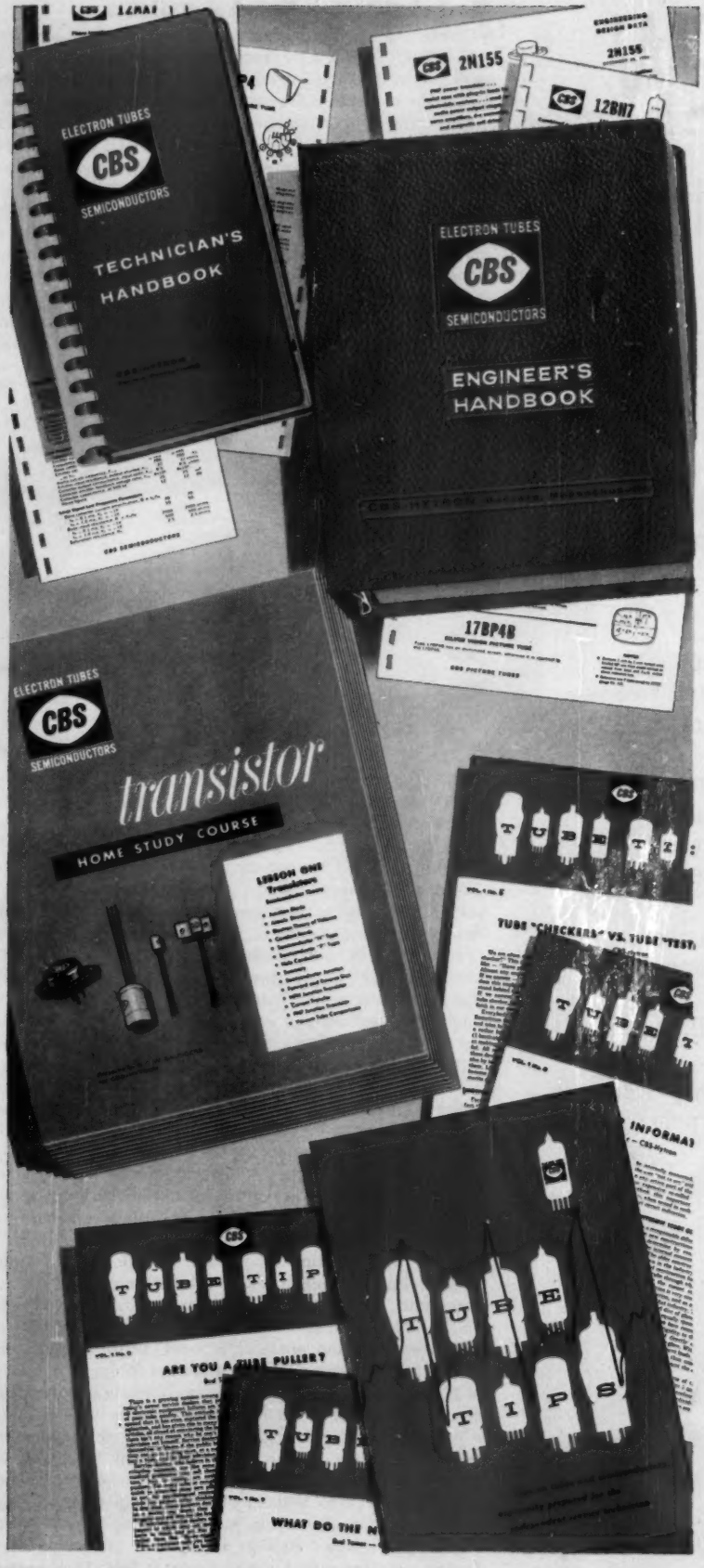
SAMPLE LESSON
64-page CATALOG
both FREE

See Other Side for more information on the Tested Way to Better Pay

NEW

THE FISHER
Model 90-R • FM-AM TUNER

■ Combining engineering excellence and dazzling performance, THE FISHER 90-R is truly representative of the renowned FISHER



To help you...

4 NEW CBS TECHNICAL AIDS

Here are four new CBS technical publications on tubes and semiconductors. Each is especially designed to make life easier for electronic technicians and engineers:

Technician's Handbook...
compact, comprehensive ready-reference data by and for the electronic service technician. Only $1.50 net.

Engineer's Handbook...
complete EIA data and two-color curves by and for engineers — and technicians who want all the facts. Only $7.50 net.

Transistor Course...
fast, fascinating home-study course — teaches basic fundamentals of transistors through use. Available from CBS Tube distributors.

Tube Tips...
monthly inside information on tubes and semiconductors — especially for service technicians. From CBS Tube distributors only.

You'll want all four of these CBS technical aids. See them . . . examine them . . . get them at your CBS Tube distributor's . . . today!

ELECTRON TUBES
CBS
SEMICONDUCTORS ®

CBS-HYTRON, Danvers, Mass.
A Division of
Columbia Broadcasting System, Inc.

For the best in entertainment tune to CBS

The Exciting NEW Anniversary Series by FISHER

IT IS APPROPRIATE that Avery Fisher, pioneer maker of high fidelity instruments, should mark his twentieth year of engineering leadership with the introduction of the new, FISHER Anniversary Series. In this group of outstanding instruments will be found two FM-AM tuners and the very latest of FISHER audio amplifiers.

Nothing we can say here, no photographic illustration we reproduce, could possibly convey the giant step forward represented by these new models. They will serve to establish even more firmly the leadership that Fisher equipment has held these two decades. Be sure to visit your high fidelity dealer soon, to *see* the Anniversary Series – and best of all, compare their performance to any competitive equipment—*regardless of price.* You are in for the most pleasant surprise of your hi-fi life!

Write today for complete specifications.

FISHER RADIO Corporation
21-23 44th Drive · Long Island City 1, N. Y.

THE FISHER
Model 90-R · FM-AM TUNER

■ Combining engineering excellence and dazzling performance, THE FISHER 90-R is truly representative of the renowned FISHER tradition for quality. Providing both maximum sensitivity and maximum signal-to-noise ratio, **without compromise**, the 90-R may even bring in FM stations **before** you have connected the FM antenna! Incorporating the celebrated FISHER **Gold Cascode** RF amplifier, and companion circuitry, the 90-R has a rated sensitivity as low as 1 microvolt—with AM sensitivity better than 3 microvolts at full output. The exclusive, new **Microbeam Tuning Indicator** provides ease of tuning **never before possible**—and is more accurate on weak signals than a meter or conventional tuning eye. Still another FISHER exclusive, the new, three-position **Push-Button FM Muting and AM Bandwidth Selector** effectively eliminates both interstation noise and annoying on-station side-response distortion. The most advanced FM-AM tuner in the world today, THE FISHER 90-R is a superb, professional instrument.

■ Outstanding specifications of the 90-R include: ■ 1 microvolt FM sensitivity for 20 db of quieting; 1.6 microvolts for 30 db of quieting, using 72-ohm antenna. ■ FM sensitivity 2 microvolts for 20 db of quieting; 3.2 microvolts for 30 db of quieting, using 300-ohm antenna. ■ 12 tuned circuits, including 3 variable. ■ Gold Cascode RF Amplifier stage. ■ Entire front end features silver-plated shielding against undesirable noise, interference and radiation. ■ Special antenna input circuit on FM and AM accommodates five different kinds of antenna connections. ■ Four IF amplifier stages provide maximum bandwidth while maintaining maximum selectivity. ■ Dual Dynamic Limiters for instantaneous limiting of random and impulse-type noise. ■ Wide Band Ratio Detector. ■ High capture ratio eliminates co-channel interference. ■ Uniform frequency response from 20 to 20,000 cycles within 1 db. ■ Delayed AGC for constant audio output. ■ FM Dipole antenna included. ■ Antenna input accommodates 300-ohm or 72-ohm external antenna. ■ Separate AM front end with 9 tuned circuits, including 3 variable. ■ AM sensitivity better than 3 microvolts for full rated output. ■ Special antenna input designed for maximum signal-to-noise ratio. ■ Convenient antenna terminal and switch permits choice of ferrite loop or external antenna. ■ Tuned RF amplifier stage has constant bandwidth over tuning range for optimum fidelity-to-selectivity ratios. ■ Two IF amplifier stages featuring three-position push-button controlled adjustable bandwidth. ■ IF bandwidth 18 Kc in Broad, 11.5 Kc in Medium, and 6 Kc in Sharp positions. ■ AM Detector circuit incorporates separate diode and operates without distortion even on high-modulation broadcast signals. ■ Special Bridged-T circuit design of 10-Kc sharp cut-off filter assures complete suppression of undesirable adjacent-channel interference, or heterodyne "whistle." ■ Two low-impedance, high-level outputs, one for amplifier and one for recording. ■ Hum and Noise Level: 77 db below signal for 2 volts output. ■ Die-cast, three-dimensional brushed-brass escutcheon. ■ Large, brilliantly illuminated dial with logging scale. ■ Pin-point indicator lights for FM muting or AM bandwidth. ■ Smooth, fly-wheel tuning. ■ 12 tubes including Microbeam Tuning Indicator, plus 6 crystal diodes. ■ Size: 15½" wide x 10⅞" deep x 7" high. ■ Shipping Weight: 21 pounds.

Chassis, **$199.50**
Mahogany or Blonde Cabinet, $19.95

HE FISHER
Model 90-T · FM-AM TUNER

■ If any FM-AM tuner possibly can offer more in performance and engineering than the 90-R, it is the equally new, FISHER Model 90-T. Here is the identical, extreme-sensitivity FM-AM tuner as the 90-R—with the **Gold Cascode RF amplifier, Microbeam Tuning** and **Push-Button FM Muting-AM Bandwidth Control**—plus an audio control center incorporating stimulating new concepts in design and engineering. A new FISHER feature, the **Presence Control**, creates the concert-hall effect of emphasizing and bringing forward from the orchestra, instrumental and solo passages. A three-position, sharp cut-off **Rumble Filter** eliminates low-frequency noise with minimum possible loss of frequency response. A similar, three-position, sharp cut-off **Noise Filter** suppresses noise, interference and other annoying high-frequency effects such as static, record scratch and high-frequency distortion. The additional tuner specifications of the FISHER 90-T FM-AM tuner are identical to the new FISHER 90-R.

■ The four input jacks of the control center can accommodate a low-level magnetic phonograph cartridge and a tape playback head, plus a stereo channel, TV sound, a ceramic, crystal or FM cartridge, tape recorder or other high level signal source. ■ Two output jacks provide a low-impedance connection for use with an amplifier or separate signal for recording. ■ Less than 0.1% distortion for 3 volts output, with uniform frequency response from 25 to 40,000 cycles, within 1 db. ■ Hum and noise level better than 80 db below signal for 2 volts output. ■ High-gain, two-stage preamplifier for low-level phonograph cartridges and tape playback head. ■ Three positions of equalization for all makes of recordings, plus standard NARTB tape equalization. ■ Individual bass and treble controls for **complete, personal tonal adjustment.** ■ Master Volume Control eliminates need for separate volume controls on associated equipment. ■ Four-position Loudness Contour Control accurately compensates for the natural loss in hearing sensitivity at low listening levels. ■ Die-cast, three-dimensional brushed-brass escutcheon. ■ Large, brilliantly illuminated dial with logging scale. ■ Pin-point channel indicator lights. ■ Smooth, fly-wheel tuning. ■ 15 tubes including Microbeam Tuning Indicator, plus 6 crystal diodes. ■ Size: 15⅛" wide x 10⅞" deep x 7" high. ■ Shipping Weight: 23 pounds.

Chassis, **$239.50**
Mahogany or Blonde Cabinet, $19.95

THE FISHER
Model 125-AX Audio Amplifier

■ 125 Watts! THE FISHER Model 125-AX sets new standards for power amplifiers—from the standpoint of design, performance and reliability. Its exceptionally high power output and significantly low distortion provide the ideal combination for quality reproduction, with ample reserve power for every requirement of the music connoisseur or professional user. The 125-AX is ideal for use with the most critical recording and laboratory instruments, in addition to the newest, low-efficiency and cone-type speaker systems.

■ Outstanding specifications of the new FISHER Model 125-AX audio amplifier include: ■ 125 watts with normal program material. ■ 90 watts continuous sine wave duty. ■ Harmonic distortion less than 0.6% at 125 watts; less than 0.5% harmonic distortion at 90 watts. ■ Two separate power supplies, assuring optimum amplifier operation. ■ Unique, illuminated FISHER Performance Monitor meter indicates correct adjustment of output tube bias, screen voltage and output balance—and shows average power in watts. ■ Less than 1% IM distortion at 90 watts; less than 2% IM distortion at 125 watts (measured 60/3000 cycles at 4:1). ■ Frequency response within 0.25 db, 20 to 20,000 cycles. ■ Hum and noise better than 92 db below full output. ■ 4, 8 and 16-ohm speaker output impedances, plus 70.7-volt output at 90 watts. ■ Power socket supplies all necessary voltages for operation of unpowered, external components. ■ Exclusive FISHER Z-Matic, a variable damping factor control with three times the range of ordinary controls of this type, assures a perfect impedance match between the amplifier and speaker system. ■ Total of eight controls: Input Level, Speaker Impedance Switch, Meter Switch, Bias, Screen Voltage, Output Balance, Driver Balance, Z-Matic. ■ Tube Complement: Total of 12, including 2 neon regulators—1-12AU7, 1-12AX7, 4-EL34 (6CA7), 1-6Y6, 1-6AU6, 2-5R4GY, 2-NE16. ■ Size: 14" wide x 11¼" deep x 8¼" high. ■ Shipping Weight: 55 pounds.

Model 125-AX, **$229.50**
Model 125-A, with 8 and 16-ohm outputs only, $219.50

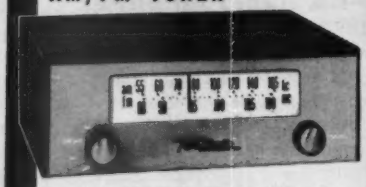
Prices Slightly Higher in the Far West.

Clip and Mail the Coupon Below—Now!

Tele Matic

CUSTOM HIGH FIDELITY KITS

AM/FM TUNER



2 uv for 20 DB quieting, AFC plus Defeat, Full Frequency Response, 300 KC bandwidth.

Model KC-400 Less Cage $34.95 (FED. EX. TAX INC.)
Wired and Tested 59.95

20-WATT INTEGRATED AMPLIFIER

Power Response CONSTANT at 20 Watts, 1 ± DB Full Frequency Response, Infinite Equalization Bass Treble Controls; 3 Hi, 1 Low inputs.

Model KC-401 Less Cage $48.00
Wired and Tested 84.95

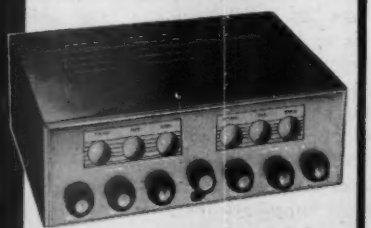
Exclusive! STEREOPHONIC KITS

AM/FM STEREOPHONIC TUNER WITH WIRED FM FRONT END

NEW DIMENSIONS IN SOUND—Each section used individually or together—0.9 uv for 20 DB quieting, 330 kc Bandwidth 3-gang variable AM tuning, 15 uv per meter loop sensitivity.

Model KB-402 Less Cage $89.95 (FED. EX. TAX INC.)
Wired and Tested 99.50

40-WATT STEREOPHONIC AMPLIFIER



NEWEST DEVELOPMENT IN STEREOPHONIC SOUND FOR THREE DIMENSIONAL LIFE-LIKE REALISM!
Twin 20-Watt Channels—Each with FULL PRE-AMP sections and Master Volume Control.

Model KB-403 Less Cage $ 82.50
Wired and Tested 108.50

For full details, see your local dealer or write

TELEMATIC INDUSTRIES, INC.

215 LEE AVENUE, BROOKLYN 6, N. Y.

Within the Industry

ALAN H. BODGE has been elected a vice-president of *Audio Devices, Inc.*, New York, N. Y. He will continue as head of the company's Los Angeles office in charge of West Coast sales.

A graduate of Dartmouth College, Mr. Bodge joined the organization in 1947.

Among other items, the company manufactures magnetic tape for sound recording, instrumentation, and electronic computer use and lacquer-coated recording *"Audiodiscs"* for radio stations, recording studios, and phonograph record manufacturers.

* * *

CHARLES P. GINSBURG, manager of advanced videotape development, *Ampex Corporation*, has received the David Sarnoff Gold Medal Award given by the Society of Motion Picture and Television Engineers.

Mr. Ginsburg was selected by the committee for his work in the development of a practical video recorder resulting from analysis of the problem, effective planning, and consideration of alternatives in making a choice of systems elements.

He joined the company in 1952 specifically to undertake videotape recorder projects. He has served as project engineer, senior project engineer, chief video engineer, and was finally elevated to his present position.

* * *

DR. BERNARD JACOBS has been appointed to the newly created post of vice-president in charge of research of *General Transistor Corporation*.

A specialist in semiconductor development, Dr. Jacobs has performed in this capacity at *Federal Telephone and Radio Corp.* and *Radio Receptor Company*. He was previously employed by the semiconductor division of *Sperry-Rand Corporation* as head of material research where he was responsible for the development of basic techniques usable in semiconductor device fabrication.

Dr. Jacobs is a member of the Scientific Research Society of America, American Physical Society, and the Institute of Radio Engineers. He is the holder of numerous patents in the field of semiconductor device development.

* * *

O. H. MACKLEY has been appointed vice-president and general manager of *Hycon Electronics, Inc.*, a wholly owned subsidiary of *Hycon Mfg. Company*.

Mr. Mackley, who joined the firm last year as technical services manager of the former military electronics division, has served as manager of the electronics subsidiary since March. Prior to joining the company, he was with *Radio Corporation of America* for over 18 years in a number of key engineering and administrative positions.

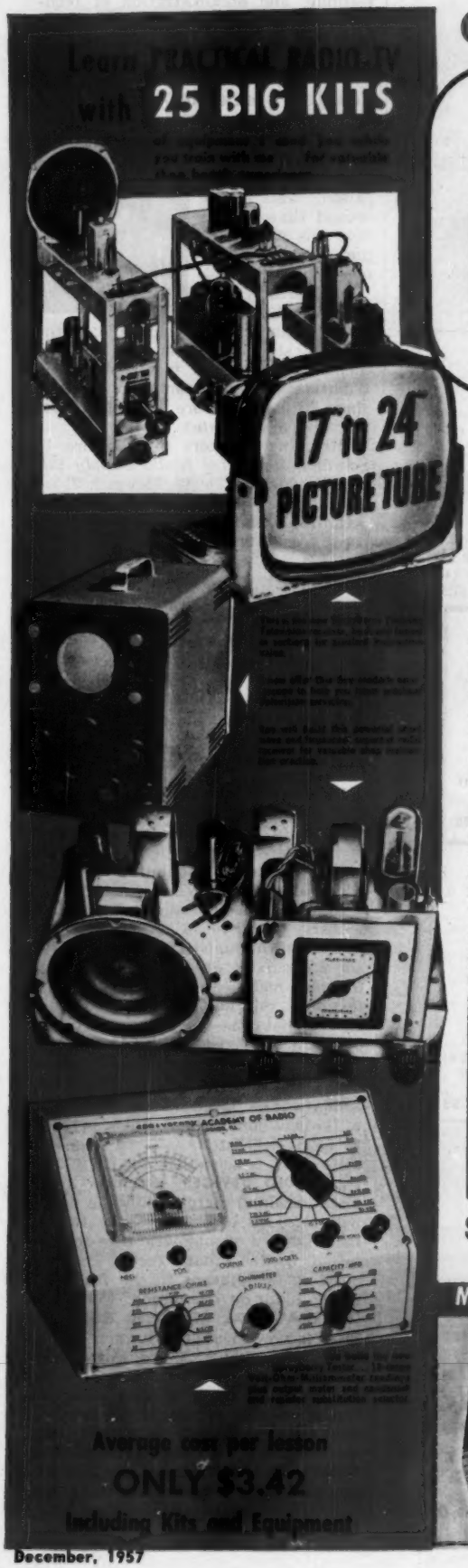
* * *

W. R. G. BAKER, vice-president of the *General Electric Company*, and Albert W. Hull, noted electron tube pioneer, are among those named to receive the 1957 awards of the Institute of Radio Engineers.

Dr. Hull, consultant to the *General Electric* research laboratory, will receive the Medal of Honor, the highest technical award in the radio-electronics field "for outstanding scientific achievement and pioneering inventions and development in the field of electron tubes." He is credited with creating a greater number of new types of electron tubes than any other man.

The Founders Award, bestowed only on special occasions to outstanding leaders in communications and electronics, will be given to Dr. Baker "for outstanding contributions to the radio engineering profession through wise and courageous leadership in the planning and administration of technical developments which have greatly

ROBERT L. STEPHENS—pioneer in electronics and high fidelity died recently of complications following surgery for a chronic hip ailment. He was the founder of the Stephens Tru-Sonic Company, now a multi-million dollar producer of high fidelity speakers in the country. For the past year he had been a consultant to the firm that bears his name, having sold his interest in the organization in 1956. Mr. Stephens was a trail-blazer in the development of true sound reproduction through better loudspeakers and microphones. His 20 years of research and production resulted in enormous contributions to the making of realistic sound in the home.



Clip and Mail the Coupon Below—Now!

Train in Spare Hours at Home for the Best Jobs and Big Pay in

Radio-Television

—my new, faster way!

Frank L. Sprayberry
Educational Director

Want Proof? Send for my big FREE CATALOG and Sample Lesson. Let the facts speak for themselves!

Why wait—get into Radio-Television fast! I will train you in as little as 10 months to step into the top paying Radio-Television field as a much-needed Service Technician! You will train entirely at home in your spare time . . . which means you can train as fast or as slowly as you like. You have a choice of THREE Sprayberry Training Plans . . . one *exactly* suited to your needs. My easier-than-ever payment terms make it possible for you to get set for the good jobs in Radio-Television without the slightest strain on your budget! Get the true facts . . . just mail the coupon for my big new 56 page fact-filled catalog plus actual sample lesson—both FREE.

REALLY PRACTICAL TRAINING—NO PREVIOUS EXPERIENCE NEEDED

My students do better because I train both the mind and the hands. Sprayberry Training is offered in 25 individual training units, each includes a practice giving kit of parts and equipment . . . all yours to keep. You will gain priceless practical experience building the specially engineered Sprayberry Television Training Receiver, Two-Band Radio Set, Signal Generator, Audio Tester and the new Sprayberry 18 range Multi-Tester, plus other test units. You will have a complete set of Radio-TV test equipment to start your own shop. My lessons are regularly revised and every important new development is covered. My graduates are completely trained Radio-Television Service Technicians.

NEWEST DEVELOPMENTS

Your training covers U H F, Color Television, F M, Oscilloscope Servicing, High Fidelity Sound and Transistors.

MAIL THE COUPON—See what's ahead in Radio-TV . . . No Salesman Will Call On You!

The coupon below brings you my big new catalog plus an actual sample Sprayberry Lesson. I invite you to read the facts . . . to see that I actually illustrate every item in my training. With the facts in your hands, you will be able to decide. No salesman will call on you. The coupon places you under no obligation. Mail it now, today, and get ready for your place in Radio-Television.

SPRAYBERRY ACADEMY OF RADIO-TELEVISION

1512 Jarvis Avenue, Dept. 25W, Chicago 26, Illinois

Mail This Coupon For Free Facts and Sample Lesson

SPRAYBERRY ACADEMY OF RADIO-TELEVISION
Dept. 25W, 1512 Jarvis Avenue, Chicago 26, Ill.

Please rush all information on your ALL-NEW Radio-Television Training Plan. I understand this does not obligate me and that *no salesman will call upon me.* Include New Catalog and Sample Lesson FREE.

Name_____ Age____

Address_____

City_____ Zone____ State_____

PRECISION

...manufacturers of fine electronic test instruments for over 25 years...

INTRODUCES

PACO

quality test instruments in **kit form**

For the first time—
a line of test instrument kits engineered and produced under the auspices of a major test equipment manufacturer... and conveniently available directly from your own local electronic parts distributor.

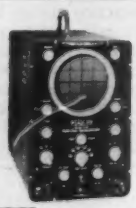
PRECISION's
25 years of experience is your assurance of **PACO's** superior quality, styling, performance and value.

COMING SOON...

Model G-30 —RF Signal Generator
Model Z-80 —Audio-RF Signal Tracer
Model M-40—High Sensitivity V-O-M

Model V-70
VACUUM TUBE VOLTMETER KIT
wide-range • peak to peak.
Net Price: $31.50

Model B-10; BATTERY ELIMINATOR KIT
• less than 0.3% ripple output.
• no external filter adaptors required.
Net Price: $41.95



Model S-50
5" CATHODE RAY OSCILLOSCOPE KIT
push-pull vertical and horizontal amplifiers.
Net Price: $47.50

Model C-20
RESISTANCE – CAPACITY-RATIO BRIDGE KIT
10 mmfd to 2000 mfd
½ ohm to 200 megohms.
Net Price: $20.95

Model T-60; TUBE CHECKER KIT
full free-point lever selector system.
Net Price: $36.75
Matching, hinged, removable cover.
Net Price: $3.95

Available and on display at leading electronic parts distributors. Write for descriptive bulletin.

PACO ELECTRONICS CO., INC.
70-31 84th Street, Glendale 27, L. I., N. Y.

A DIVISION OF ***PRECISION*** Apparatus Company, Inc.

Export: 458 Broadway, New York 13, New York
Canada: Atlas Radio Corp., Ltd., 50 Wingold Ave., Toronto 10, Ont.

planning and administration of technical developments which have greatly increased the impact of electronics on the public welfare."

* * *

CHARLES GOLENPAUL, vice-president of *Aerovox Corporation,* has been elected president of the Electronic Industry Show Corporation. This is the second time he has held this office, having served previously in 1948.

An industry pioneer, Mr. Golenpaul is the man who first introduced the idea of standard parts and replacements sold through independent distributors. He has been with the firm since 1930 and before that was sales manager of *Clarostat.*

Other new officers are: Mauro E. Schifino, *Rochester Radio Supply Co.,* vice-president; Lew W. Howard, *Triad Transformer Corp.,* secretary; and Roy S. Laird, *Ohmite Manufacturing Company,* treasurer.

* * *

SCOTT HELT Memorial Award has been established by the administrative committee of the Professional Group on Broadcast Transmission Systems of the Institute of Radio Engineers.

This is the first Professional Group award and is established in memory of Mr. Helt who died in 1956. It will be awarded annually for the best paper published in the Transactions of the Group.

Mr. Helt was an original member of the committee from 1948 until his death. He also served as a member of the Transactions papers review subcommittee and contributed much in editorial talent and interest.

A veteran in the radio and television industry for 32 years, his last post was as patent administrator at *Allen B. Du Mont Laboratories, Inc.* Prior to that he had been in charge of professional relations for the firm and before that was chief engineer of the company's television network.

* * *

SWITCHCRAFT, INC. will move and consolidate three locations under one roof in its new home which is being erected at 5555 N. Elston Ave., Chicago, Ill. This move is scheduled for early 1958 . . . **AUDIO DEVICES, INC.** has leased an additional factory building which will raise its operating space for the manufacture of magnetic tape to a total of 60,000 square feet. The new building is adjacent to the firm's existing plant in Glenbrook, Conn. . . . **INTERNATIONAL RECTIFIER CORPORATION** is now located at its new administration building, 233 Kansas Street, El Segundo, Calif. . . . Ground has been broken on a million-dollar addition to the physics laboratory of **SYLVANIA ELECTRIC PRODUCTS INC.,** Bayside, N. Y. . . . **MAGNETIC INSTRUMENTS COMPANY** has completed a move of all its operations to a new

(*Continued on page* 158)

the specs prove it

NEW! DYNAMIC

5" PUSH-PULL

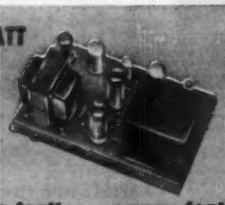
NEW! 12-WATT Williamson-type HIGH FIDELITY INTEGRATED AMPLIFIER HF12

with Preamplifier, Equalizer & Control Section

KIT $34.95 WIRED $57.95

Compact, beautifully packaged & styled. Provides complete "front-end" facilities and true high fidelity performance. Direct tape head & magnetic phono inputs with NARTB (tape) & RIAA (phono) feedback equalizations. 6-tube circuit, dual triode for variable turnover bass & treble feedback-type tone controls. **Output Power:** 12 w cont., 25 w pk. **IM Dist.** (60 & 6000 cps @ 4:1): 1.5% @ 12 w; 0.55% @ 6 w; 0.3% @ 4 w. **Freq. Resp.:** 1 w: ±0.5 db 12 cps – 50 kc; 12 w: ±0.5 db 25 cps – 20 kc. **Harmonic Dist:** 20 cps: 2% @ 4.2 w; 1½% @ 2.5 w; 30 cps: 2% @ 11 w; 1½% @ 6.3 w; 40 cps: 1% @ 12 w; 1½% @ 9.3 w; 3000 cps: 1½% @ 12 w; 10 kc: 1% @ 10 w; 1½% @ 6 w. **Transient Resp:** excellent square wave reproduction (4 usec rise-time); negligible ringing, rapid settling on 10 kc square wave. **Inverse Feedback:** 20 db. **Stability Margin:** 12 db. **Damping Factor:** above 8, 20 cps – 15 kc. **Speaker Connections:** 4, 8, 16 ohms. **Tone Control Range:** @ 10 kc, ±13 db; @ 50 cps, ±16 db. **Tubes:** 2-ECC83/12AX7, 1-ECC82/12AU7, 2-EL84, 1-EZ81. Size: HWD: 3¼" x 12" x 8¼". 13 lbs. Mounts in and out of cabinet.

NEW! 50-WATT Ultra-Linear HIGH FIDELITY POWER AMPLIFIER



HF50 KIT $57.95 WIRED $87.95

Like the HF60 shown below, the HF50 features **virtually absolute stability, flawless transient response** under either resistive or reactive (speaker) load, & **no bounce or flutter** under pulsed conditions. **Extremely high quality output transformer** with extensively interleaved windings, 4, 8, & 16 ohm speaker connections, grain-oriented steel, & fully potted in seamless steel case. Otherwise identical to HF60. **Output Power:** 50 w cont., 100 w pk. **IM Distortion** (60 & 6000 cps @ 4:1): below 1% at 50 w; 0.5% @ 45 w. **Harmonic Dist.:** below 0.5% between 20 cps & 20 kc within 1 db of rated power. **Freq. Resp. at 1 w:** ±0.5 db 6 cps –60 kc; ±0.1 db 15 cps –30 kc at any level from 1 mw to rated power; no peaking or raggedness outside audio range. **All other specs identical to HF60 below.** Matching Cover **E-2 $4.50.**

NEW! 50-WATT Ultra-Linear HIGH-FIDELITY INTEGRATED POWER AMPLIFIER HF52

with Preamplifier, Equalizer & Control Section

KIT $69.95 WIRED $109.95

Combines a power amplifier section **essentially identical to the HF50 power amplifier** with a **preamp-equalizer control section similar to HF20 below.** Provision for use with electronic crossover network & additional amplifier(s). See HF50 for response & distortion specs; HF60 for square wave response, rise-time, inverse feedback, stability margin, damping factor, speaker connections; HF20 for preamplifier, equalizer & control section description. Hum & noise 60 db below rated output on magnetic phono input (8 mv input for rated output), & 75 db below rated output on high level inputs (0.6 v input for rated output). Matching Cover **E-1 $4.50.**

The specs are the proof...

7 NEW BEST BUYS by EICO®

NEW

HIGH FIDELITY PREAMPLIFIER

#HF61A KIT $24.95, WIRED $37.95

With Power Supply: #HF61 KIT $29.95, WIRED $44.95

Will not add distortion or detract from the wide-band or transient response of the finest power amplifiers at any control settings. High quality feedback circuitry throughout plus the most complete control & switching facilities. Heavy-gauge solid brushed brass panel, concentric controls, one-piece brown enamel steel cabinet for lasting attractive appearance. **Feedback-type, sharp cut-off (12 db/octave) scratch & rumble filters. Low-distortion feedback equalization:** 5 most common recording curves for LPs & 78s including RIAA. **Low-distortion feedback tone controls:** provide large boost or cut in bass or treble with mid-freqs & volume unaffected. **Centralab printed-circuit Sonicr "Compentrol" loudness control** with **concentric level control. 4 hi-level switched inputs** (tuner, tv, tape, aux.) & **3 low-level inputs** (separate **front panel low-level input selector** permits concurrent use of changer & turntable). **Proper pick-up loading & attenuation provided for all** quality cartridges. **Hum bal. control.** DC superimposed on filament supply. **4 convenience outlets. Extremely flat wideband freq. resp.:** ±1 db 6-100,000 cps; ±0.5 db 12-50,000 cps. **Extremely sensitive. Negligible hum, noise, harmonic or IM distortion. Size:** 4-7/8" x 12-5/16" x 4-7/8". 8 lbs.

NEW

60-WATT Ultra-Linear HIGH FIDELITY POWER AMPLIFIER #HF60 with ACRO TO-330 OUTPUT TRANSFORMER

KIT $72.95 WIRED $99.95

Superlative performance, obtained through finest components & circuitry. EF86 low-noise voltage amplifier direct-coupled to 6SN7GTB cathode coupled phase inverter driving a pair of Ultra-Linear connected push-pull EL34 output tubes operated with fixed bias. **Rated power output:** 60 w (130 w peak). **IM Distortion** (60 & 6000 cps at 4:1): less than 1% at 60 w; less than 0.5% at 50 w. **Harmonic Distortion:** less than 0.5% at any freq. between 20 cps & 20 kc within 1 db of 60 w. **Sinusoidal Freq. Resp.:** at 1 w: ±0.5 db 5 cps –100 kc; ±0.1 db 15 cps to 35 kc at any level from 1 mw to rated power; no peaking or raggedness outside audio range. **Square Wave Resp.:** excellent from 20 cps to 25 kc, 3 usec rise-time. **Sensitivity:** 0.55 v for 60 w. **Damping Factor:** 17. **Inverse Feedback:** 21 db. **Stability Margin:** 16 db. **Hum:** 90 db below rated output. **ACRO TO-330 Output Transformer** (fully potted). **Speaker Taps:** 4, 8, 16 ohms. **GZ34 extra-rugged rectifier** (indirectly-heated cathode eliminates high starting voltage on electrolytics & delays B+ until amplifier tubes warm up). **Input level control.** Panel mount fuse holder. Both **bias** and DC — **balance** adjustments. Std octal socket provided for pre-amplifier power take-off. Size: 7" x 14" x 8". 30 lbs. Matching cover **Model E-2 $4.50.**

NEW

COMPLETE with Preamplifier, Equalizer & Control Section 20-WATT Ultra-Linear Williamson-Type HIGH FIDELITY AMPLIFIER #HF-20

KIT $49.95 WIRED $79.95

A low-cost, complete-facility amplifier of the highest quality that sets a new standard of performance at the price, kit or wired. **Rated Power Output:** 20 w (34 w peak). **IM Distortion (60 & 6000 cps/4:1) at rated power:** 1.3%. **Max. Harmonic Distortion between 20 & 20,000 cps at 1 db under rated power:** approx. 1%. **Mid-band Harmonic Distortion at rated power:** 0.3%. **Power Response (20 w):** ±0.5 db 20-20,000 cps; ±1.5 db 10-40,000 cps. **Freq. Resp.** (¼ w): ±0.5 db 13-35,000 cps; ±1.5 db 7-50,000 cps. **5 feedback equalizations** for LPs & 78s. **Low-distortion feedback tone controls:** large boosts or cuts in bass or treble with mid-freqs. & volume unaffected. Loudness control & separate level set control on front panel. Low Z output to tape recorder. **4 hi-level switched inputs:** tuner, tv, tape, aux; **2 low-level inputs** for proper loading with **all** cartridges. **Hum bal. control.** DC superimposed on filament supply. **Extremely fine** output transformer: interleaved windings, tight coupling, careful balancing, grain-oriented steel. 8½" x 15" x 10". 24 lbs.
Matching cover **Model E-1, $4.50.**

NEW COMPLETE with FACTORY-BUILT CABINET — 2-WAY HI-FI SPEAKER SYSTEM #HFS1 $39.95

Genuine 2-way book-shelf size speaker system **Jensen** heavy duty 8" woofer (6.8 oz. magnet) & matching **Jensen** compression-driver exponential horn tweeter with level control. Smooth clean bass & crisp extended highs free of coloration or artificial brilliance. **Factory-built** tuned bass reflex birch hardwood cabinet (**not** a kit) constructed to high quality standards. Neutral acoustical grille cloth framed by a smooth-sanded solid birch molding. **Freq. Resp.** measured 2 ft. away on principal axis in anechoic chamber with 1 watt input —**Woofer:** ±4 db 80-1800 cps; **Tweeter:** ±2 db 2800-10,000 cps; **Crossover Region:** 1800-2800 cps, shift in level over this region depends on tweeter level control setting. Power-handling capacity: 25 watts. Size: 23" x 11" x 9". 25 lbs. **Wiring Time:** 15 min.

See the **"BEST BUYS" NOW IN STOCK** at your nearest distributor. Fill out coupon on other side for **FREE CATALOG.**

Prices 5% higher on West Coast.

EICO® **33-00 Northern Blvd., L. I. C., N.Y.**

Turn page for other EICO ad.

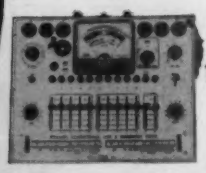
the specs prove it . . your BEST BUY is EICO®

for COLOR & Monochrome TV servicing

FREE CATALOG

shows you HOW TO SAVE 50% on 50 models of top quality professional test equipment.

MAIL COUPON NOW!

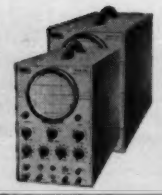


NEW! DYNAMIC CONDUCTANCE TUBE & TRANSISTOR TESTER #666

KIT $69.95 WIRED $109.95

COMPLETE with steel cover and handle.

SPEED, ease, unexcelled accuracy & thoroughness. **Tests all receiving tubes** (and picture tubes with adapter). **Composite indication** of Gm, Gp & peak emission. **Simultaneous sel** of any 1 of 4 combinations of 3 plate voltages, 3 screen voltages, 3 ranges of continuously variable grid voltage (with 5% accurate pot). **New series-string voltages:** for 600, 450, 300 ma types. **Sensitive** 200 ua meter. **5 ranges meter sensitivity** (1% shunts & 5% pot). **10 SIX-position lever switches:** freepoint connection of each tube pin. **10 pushbuttons:** rapid insert of any tube element in leakage test circuit & speedy sel. of individual sections of multi-section tubes in merit tests. **Direct-reading** of inter-element leakage **in ohms. New gear-driven rollchart. Checks n-p-n & p-n-p transistors:** separate meter readings of **collector leakage current & Beta** using internal dc power supply. Deep-etched satin aluminum panel; rugged grey wrinkle steel cabinet. **CRA Adapter $4.50**



5" PUSH-PULL OSCILLOSCOPE #425

KIT $44.95

Wired $79.95

•

7" PUSH-PULL OSCILLOSCOPE #470

KIT $79.95

Wired $129.50

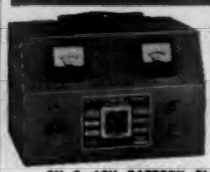
TUBE TESTER #625

KIT $34.95

Wired $49.95

- tests 600 mil series string type tubes
- illuminated roll-chart

Pix Tube Test Adapter $4.50



Sep. volt-meter & ammeter

KIT $29.95

Wired $38.95

6V & 12V BATTERY ELIMINATOR & CHARGER #1050

Sep. hi-gain RF & lo-gain audio inputs. Special noise locator. Calibrated wattmeter.

KIT $24.95

Wired $39.95

DELUXE MULTI-SIGNAL TRACER #147

20,000 Ohms/Volt MULTIMETER #565

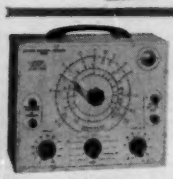
KIT 24.95

Wired $29.95

1000 Ohms/Volt MULTIMETER #536

KIT $12.90

Wired $14.90



Reads 0.5 ohms —500 megs, 10 mmfd—5000 mfd, power factor.

KIT $19.95

Wired $29.95

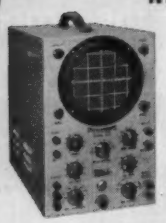
R-C BRIDGE & R-C-L COMPARATOR #950B

NEW! TV-FM SWEEP GENERATOR & MARKER #368

KIT $69.95 WIRED $119.95

Entirely electronic sweep circuit (no mechanical devices) with accurately-biased inductor for excellent linearity. **Extremely flat RF output:** new AGC circuit automatically adjusts osc. for max. output on each band with min. ampl. variations. **Exceptional tuning accuracy:** edge-lit hairlines eliminate parallax. **Swept Osc. Range** 3-216 mc in 5 fund. bands. **Variable Marker Range** 2-75 mc in 3 fund. bands; 60-225 mc on harmonic band. **4.5 mc Xtal Marker Osc., xtal supplied.** Ext. Marker provision. Sweep Width 0-3 mc lowest max. deviation to 0-30 mc highest max. dev. 2-way blanking. Narrow range phasing. Attenuators: Marker Size, RF Fine, RF Coarse (4-step decade). Cables: output, 'scope horiz., 'scope vertical. Deep-etched satin aluminum panel; rugged grey wrinkle steel cabinet.

NEW! COLOR and Monochrome DC to 5 MC LAB & TV 5" OSCILLOSCOPE #460



KIT $79.95 WIRED $129.50

- **Features DC Amplifiers!**

Flat from DC-4.5 mc, usable to 10 mc. **VERT. AMPL.:** sens. 25 rms mv/in; input Z 5 megs; direct-coupled & push-pull **throughout;** K-follower coupling bet. stages; 4-step freq-compensated attenuator up to 1000:1. **SWEEP:** perfectly linear 10 cps-100 kc (ext. cap. for range to 1 cps); **preset TV V & H positions;** auto. sync. ampl. & lim. **PLUS:** direct or cap. coupling; bal. or unbal. inputs; edge-lit engraved lucite graph screen; dimmer; filter; bezel fits std photo equipt. High intensity trace CRT. 0.06 usec rise time. Push-pull hor. ampl., flat to 400 kc, sens. 0.6 rms mv/in. Built-in volt. calib. Z-axis mod. Sawtooth & 60 cps outputs. Astig. control. Retrace blanking. Phasing control.

NEW! RF SIGNAL GENERATOR #324

KIT $26.95 WIRED $39.95

150 kc to 435 mc with ONE generator! Better value than generators selling at 2 or 3 times its cost! Ideal for IF-RF alignment, signal tracing & trouble-shooting of TV, FM, AM sets; marker gen.; 400 cps audio testing; lab. work. **6 fund. ranges: 150-400 kc, 400-1200 kc, 1.2-3.5 mc, 3.5-11 mc, 11-37 mc, 37-145 mc; 1 harmonic band 111-435 mc. Freq. accurate to ±1.5%;** 6:1 vernier tuning & excellent spread at most important alignment freqs. **Etched tuning dial,** plexiglass windows, **edge-lit hairlines.** Colpitts RF osc. **directly plate-modulated by K-follower for** improved mod. **Variable depth of int. mod. 0-50%** by 400 cps Colpitts osc. **Variable gain ext. amplifier:** only 3.0 v needed for 30% mod. **Turret-mounted coils slug-tuned** for max. accuracy. Fine & Coarse (3-step) RF attenuators. RF output 100,000 uv; AF sine wave output to 10 v. 50-ohm output Z. 5-way jack-top binding posts for AF in/out; coaxial connector & shielded cable for RF out. 12AU7, 12AV7, selenium rectifier; xmfr-operated. Deep-etched satin aluminum panel; rugged grey wrinkle steel cabinet.

NEW! PEAK-to-PEAK VTVM #232 & UNI-PROBE (pat. pend.)

KIT $29.95 WIRED $49.95

Half-turn of probe tip selects DC or AC-Ohms.

Uni-Probe — exclusive with EICO — only 1 probe performs all functions!

Latest circuitry, high sensitivity & precision, wide ranges & versatility. **Calibration without removing from cabinet.** New balanced bridge circuit. High Z input for negligible loading. 4½" meter, can't burn-out circuit. **7 non-skip ranges on every function.** 4 functions: +DC Volts, −DC Volts, AC Volts, Ohms. Uniform 3 to 1 scale ratio for extreme wide-range accuracy. **Zero center.** One zero-adj. for all functions & ranges. **1% precision** ceramic multiplier resistors. Measure **directly** peak-to-peak voltage of complex & sine waves: 0-4, 14, 42, 140, 420, 1400, 4200. DC/RMS sine volts: 0-1.5, 5, 15, 50, 150, 500, 1500 (up to 30,000 v with HVP probe & 250 mc with PRF probe). Ohms: 0.2 ohms to 1000 megs. 12AU7, 6AL5, selenium rectifier; xfmr-operated. Deep-etched satin aluminum panel, rugged grey wrinkle steel cabinet.

VTVM PROBES	KIT	Wired
Peak-to-Peak	$4.95	$6.95
RF	$3.75	$4.95
High Voltage Probe-1		$8.95
High Voltage Probe-2		$4.95
SCOPE PROBES		
Demodulator	$3.75	$5.75
Direct	$2.75	$3.95
Low Capacity	$3.75	$5.75

EICO, [illegible] Blvd., L.I.C. 1, N. Y. R-12

Show me HOW TO SAVE 50% on Test Equipment and Hi-Fi. Send me FREE Catalog and name of neighborhood distributor.

Name .....

Address .....

City ..... Zone ..... State .....

TURN PAGE FOR MORE EICO VALUES

EICO®

L.I.C. 1, N.Y.

Prices 5% higher on West Coast

Send for FREE CATALOG now

tenna gains at each end. In such a

Antenna Applications in Two-Way Radio Systems

By TOM J. McMULLIN
Communications Engineering Co.

Practical information on performance of directive antennas for mobile radio bands 25-50 mc., 72-76 mc., 148-174 mc.

WITH the growth of two-way radio, greater use is being made of antennas which will improve system performance and reduce interference. Particularly is this true in the 25-50 mc. band where maximum performance is required in the face of growing interference problems due to channel crowding and concentration of activities.

In the past several years considerable improvements have been made in transmitting and receiving equipment to help meet this problem. Since the antenna is a most vital part of the two-way system, it too must keep pace with developments and be used where applicable to the requirements.

In the mobile two-way radio field, improvement of system performance through use of antennas is limited, for practical reasons, to the base and fixed stations. This discussion will, therefore, be limited to antennas for base and fixed stations in the commonly used bands of 25-50 mc., 72-76 mc., and 148-174 mc. with emphasis on the 25-50 mc. band where most of the systems requiring maximum range operate.

Use of Directive Antennas

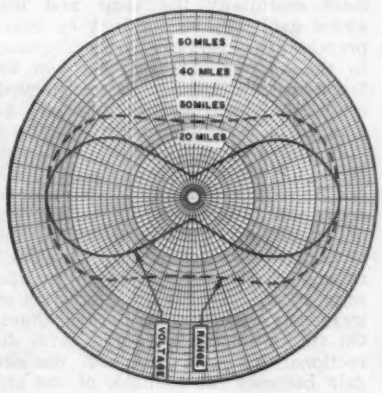
Directive antennas can be used to: (1) improve coverage where the area is not circular in shape or where the base station is not in the center of the area; (2) reduce interference between stations in the same area; and, (3) reduce interference from noise sources which are directional.

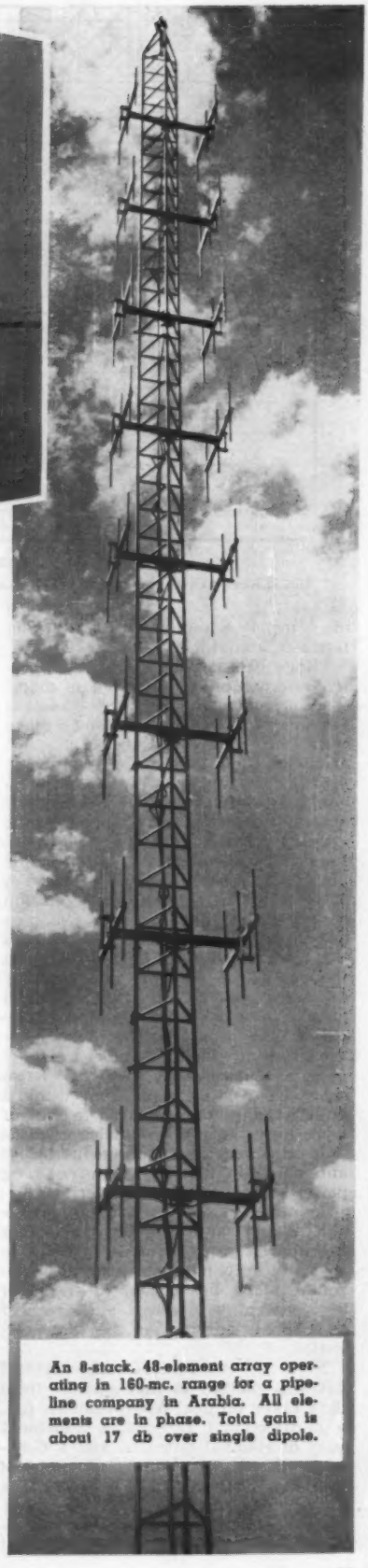
Where can directive antennas be used to improve base station coverage? Most engineers already are familiar with the use of directive antennas for fixed station point-to-point application such as the remote control of a base station by means of a radio control circuit. Many do not realize, however, that directive antennas have a wide field of application for base station coverage.

Radiation patterns of directive antennas are misleading in terms of what the range pattern will be. The usual pattern shown in values of relative power or relative voltage makes the antenna *look* very directive, which in turn makes the range look attractive in the major lobes and very poor in other directions. The range of a system does *not* vary directly with the voltage or power of the system. "Line-of-sight" distances can be covered with very low power, while distances beyond the radio horizon require greatly increasing values of power. This factor tends to smooth out the "nulls" and "lobes" of a directive antenna pattern when the pattern is translated into terms of range.

Fig. 1 shows the conventional figure-8 pattern of a bi-directional antenna plotted in terms of radiation in relative voltage (inside curve), and the coverage pattern which this becomes (outside curve) when translated into terms of range at antenna height of 200 feet, for a 50-watt mobile unit, 50 mc. talk-back to the station with a signal of 1.5 microvolts at the 50-ohm input of the receiver. Note how the figure-8 voltage pattern is changed to

Fig. 1. Measured horizontal radiation pattern of bi-directional antenna (CE214).





An 8-stack, 48-element array operating in 160-mc. range for a pipeline company in Arabia. All elements are in phase. Total gain is about 17 db over single dipole.

required. In certain instances, considerable alleviation of skip interference

plane antenna mounted on a support arm out from the side of the tower is

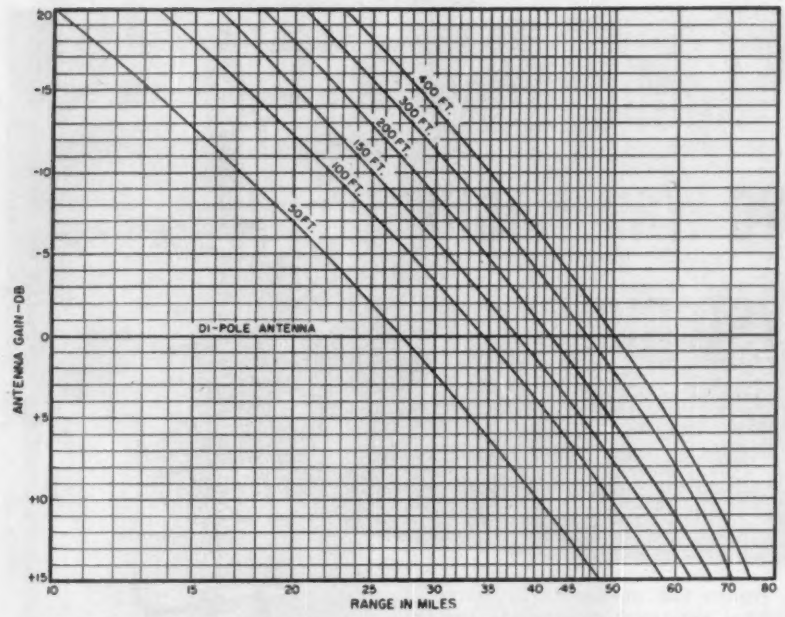


Fig. 2. Range chart showing effect of base station antenna gains and tower heights.

more nearly a rectangular pattern in terms of actual operating range.

Range patterns for any given directive antenna or combinations of directive antennas similarly can be plotted for given tower height using range charts or range calculators which are available. Fig. 2 is a range chart showing how the range varies with antenna gain respective to a vertical dipole (ground plane or coaxial half-wave radiator) based upon average conditions at 50 mc., for a 50-watt mobile unit talking back to the station with a signal strength input to the station receiver of 1.5 microvolts. On such charts or calculators, decibels (db) is the most convenient form to express the gain since db gain can be easily added or subtracted. If the antenna gain or loss is known at various azimuths, the range can be quickly determined at those azimuths for any given antenna height. Such charts also show the relative gain from using a directive antenna compared to that of more tower height, and indicate where it is economically advantageous to use antenna gain instead of increasing power or using a higher tower.

In order to conveniently use available charts and calculators to plot antenna range patterns, it is desirable that the antenna pattern in the horizontal plane be plotted in terms of decibels gain (or loss) with respect to a dipole antenna at the same elevation.

Figs. 3A, 3B, and 3C show typical patterns plotted in this manner from data taken on field measurements for: a bi-directional antenna, a 3-element yagi directional antenna, and a 6-element directional antenna composed of two 3-element yagis fed in-phase. The 6-element directional antenna can be changed to a bi-directional by reversing directions on one of the 3-element yagi sections. Its gain in each direction will be somewhat greater than that of the 2-element bi-directional of Fig. 3A.

Thus, it can be seen that "range patterns" can be plotted for a directive antenna, a combination of directive antennas, or combination of directive antenna with non-directional antenna for a given frequency range and given antenna height. If the range scale is selected to match a common map scale, the directive antenna or combination of antennas can be selected which will most nearly fit the coverage area outlined on the map. Height of tower can be scaled down or up without materially changing the shape of the pattern —just the size.

Stacking for Added Gain

In the antenna arrays just discussed most of the gain is obtained by changing the horizontal pattern from a circular configuration. If more gain is desired, and the tower height will warrant the installation, two or more antennas can be vertically stacked. The horizontal pattern shape will remain essentially the same and the added gain will be obtained by compressing the vertical pattern closer to the horizon. The pattern can be broadened by fanning out the stacked antennas with corresponding loss in gain in the maximum direction.

In the 150-mc. band, as many as eight 6-element antennas (CE286) can be vertically stacked in a colinear array with a spacing between centers of around one wavelength, fed in-phase, and will have a gain of approximately 17 db over a dipole at the same height. This is the equivalent of increasing the power by over 50 times. On station-to-station contact with directional arrays at each end, the net gain becomes the multiple of the antenna gains at each end. In such a case, gains of around 2500 times in power are practicable. This means lower tower height, less transmitter power, and circuits which would not be possible with a standard type antenna.

Directive antennas can also be used in conjunction with non-directive or general coverage antennas to cover a corner or sector of the area not being reached by the general coverage antenna. Maximum efficiency is obtained by bringing down separate antenna leads to separate receivers and switching the transmitter to the desired antenna, automatically muting the receiver not used. At a sacrifice of around 3 db in each antenna, these antennas can be parallelled at the top of the tower and fed in-phase by one cable. The directive antenna should be placed approximately one-half to a full wavelength above or below the non-directive antenna. The vertical separation between the antennas should be such that the near elements are separated by around one-quarter wavelength and in most cases it is desirable that they be fed in-phase.

Effect of Noise

Although an antenna is a bi-lateral device and works equally well on transmit and receive, certain considerations must be given to ambient electrical noise picked up by the antenna. If the noise is generally distributed throughout 360°, then the signal-to-noise improvement will be comparable to the gain of the antenna. If the noise comes principally from sectors lying outside of the maximum radiation lobes, then the signal-to-noise improvement may be greater than the gain of the antenna. Conversely, if the noise sources lie principally in the beam of the antenna, there may be little or no improvement in signal-to-noise over a non-directional antenna. In planning station installations wherein directional antennas will be used, it is a wise practice to locate the station tower on the side of the city or built-up industrial area where the antenna will not have to shoot over the high noise levels. In checking for noise sources surrounding the proposed tower location, it is also good practice to investigate at further distances in the general direction the antenna will point than would be done for a non-directional antenna. It must be remembered that the gain of the antenna will effectively bring the noise source closer in the same manner that field glasses will bring a visible object closer.

Reducing Signal Interference

It is apparent that many cases of co-channel interference in the same general area can be reduced by practical application of directional antennas. The greatly increased expansion of radio facilities and the limitation of useful frequencies available point more and more to the future necessity of putting the signal only where it is

required. In certain instances, considerable alleviation of skip interference can be achieved, although in most cases this is difficult because of conflicting demands of system coverage plus skip interference.

In addition to co-channel interference, the effects of interference from transmitter noise, desensitization and intermodulation often can be successfully countered by antenna directivity. In general, a reduction of 7 db is the equivalent of moving the interfering source twice as far away and controlling antenna pattern radiation often is a practical method of reducing a troublesome signal.

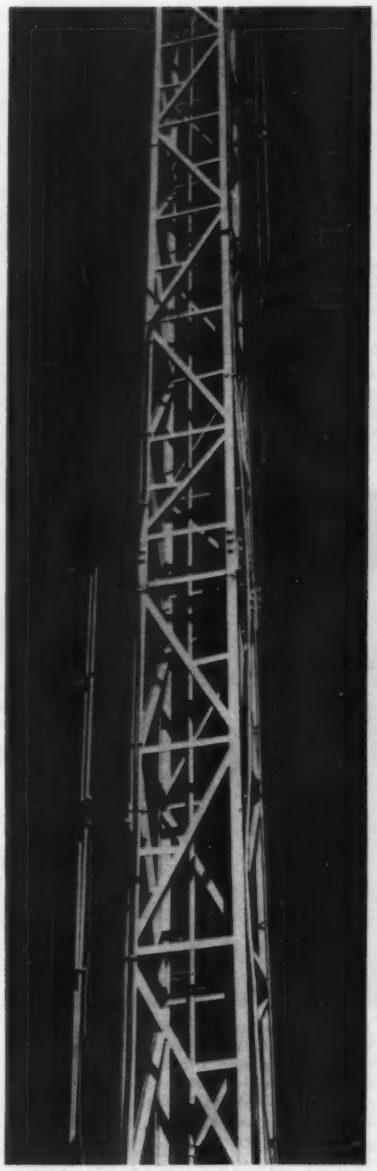
Side Mounted Antennas

At v.h.f. and u.h.f. frequencies commonly used in two-way communications, the only purpose of a high tower is to elevate the antenna above the ground level and extend the radio horizon. A high tower is generally one of the major items of expense, as well as the major "headache" item in installing a system. The increasing difficulties of obtaining suitable quiet locations at reasonable cost around cities with fast growing industrial and residential areas, which are sufficiently removed from airports and airways, have caused a number of users to mount antennas on the sides of existing two-way or broadcast and TV towers. Where the frequencies are compatible, this often is a satisfactory solution and results in greatly reduced capital investment and flexibility if change in location may be required. It also may be a good investment or return on investment for the tower owner, and a number of tower contractors are erecting towers up to 500 feet high for the express purpose of leasing space to two-way users. With modern equipment of good design, stations as close as 500 kc. in frequency can be located on the same tower without interference. At some locations five or more separate systems are located on the same tower with separate antenna systems and are operating without interference.

The conventional coaxial or ground plane antenna mounted on a support arm out from the side of the tower is not well suited to such application. Unless properly balanced around the tower, a number of such installations tend to overload the tower and endanger its safety during high wind or heavy icing. Of greater consideration, however, is the strong possibility of upsetting the antenna radiation pattern due to the capacitance and shielding effect offered by the tower structure itself. Quite often an otherwise good antenna will show decided directional effects that are quite unpredictable.

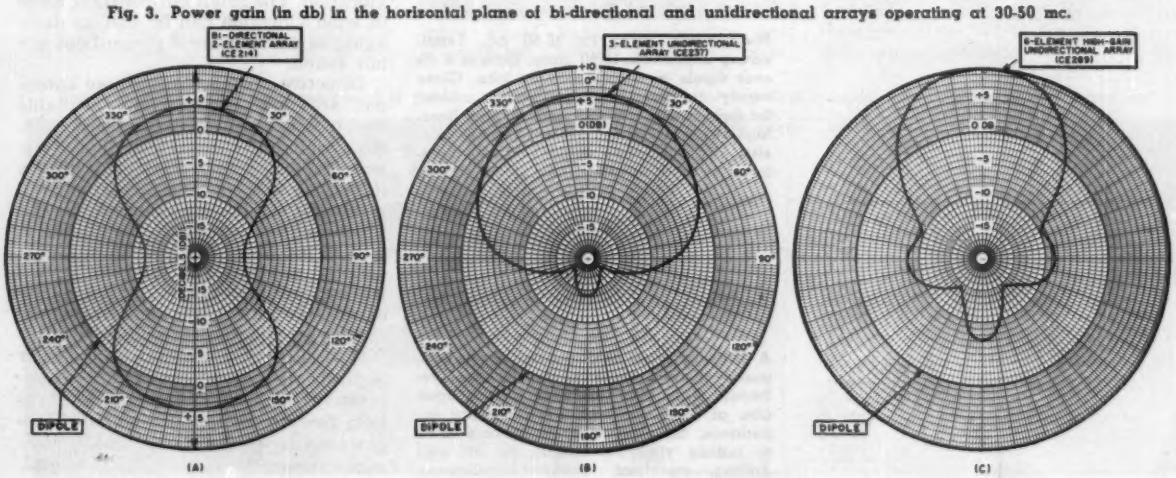
To overcome this problem and to simplify installation, antennas have been developed consisting of folded dipoles mounted close into the tower, vertically stacked on opposite sides and fed in phase. The antennas are provided with integral mountings to keep them at a fixed distance from the tower structure. The capacitance of the tower is taken into consideration in the adjustment and matching of the antenna. When these dipoles are mounted on opposite sides of the tower and staggered vertically so that the spacing from center to center is around three-quarter wavelength (near ends separated by at least several feet), the effective horizontal radiation pattern will be very nearly circular. The natural question is, "How does such an antenna perform compared to a ground plane or coaxial half-wave antenna mounted on top of the tower?"

Such an antenna is practical only where the tower cross section dimension is less than one-quarter wavelength of the operating frequency. Otherwise, radiation from the dipoles on opposite sides would produce con-



A side of tower mount antenna which gives an essentially omnidirectional pattern. Half-wave folded dipoles fed in-phase at fixed distance mounts are attached to opposite legs or sides of tower. Vertical spacing is from three-quarters to a full wavelength center to center. Frequency range is 25-50 mc. A small 450-mc. yagi antenna with a reflector and 3 directors is also shown near the upper folded dipole.

Fig. 3. Power gain (in db) in the horizontal plane of bi-directional and unidirectional arrays operating at 30-50 mc.



No. of Elements	Gain (in db)	Total spread on tower (40 mc.)	Min. Tower Height
2	0-2	30-36 ft.	100 ft.
4	3-5	66-84 ft.	250 ft.
6	4-6	102-136 ft.	350 ft.
8	6-8	138-180 ft.	450 ft.

Table 1. Gains in typical installations.

siderable distortion from a circular pattern and we would be back where we started with a standard antenna.

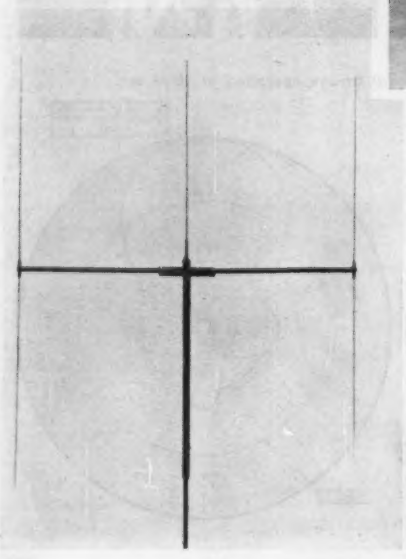
At 150 mc., applications for use of folded dipoles for side-of-tower mounting are limited to relatively small towers—if an omni-directional pattern is desired. If the tower faces exceed approximately 10 inches, out-of-phase components will partially cancel the effective gain. For larger towers this means that only the top of the tower can be utilized—using a pipe extension. If an omni-directional pattern is not required, and coverage primarily is over a 180-degree sector, the half-wave elements can be stacked on the same tower leg, with resultant gain depending on the number of elements employed.

In the 25-50 mc. band, tower faces of between two to four feet can be used and this makes available most guyed towers. Table 1 lists the gains to be realized on typical installations compared to a half-wave dipole at the same effective height.

If one 180-degree sector is to be favored, then the half-wave folded dipole elements can be stacked in-line on the same tower leg. This will result in up to 3 db additional gain and a corresponding loss over the back 180-degree sector.

The side-mount antenna is easy to mount and readily accessible for inspection. It does not clutter up the tower appearance and has minimum effect upon the impedance of an AM broadcast tower. Furthermore, experience has shown that the side-mount antenna is less susceptible to lightning damage and to precipitation static.

A 6-element unidirectional array operating at 72-76 mc. Consists of two 3-element yagi antennas one-half wavelength apart and fed in phase. Gain is 10 db over dipole. Matches a 50-ohm coaxial line.



A 3-element yagi unidirectional array composed of coax radiator, director, and reflector. Gain is 6 db over dipole, operates at 33-50 mc. with 50 ohm input impedance. Stainless steel whips are used to reduce vibration fatigue for oil well drilling rig and barge installations.

Design of Directive Antennas

It is said that there is nothing new under the sun and basically this is true in the design of antennas. The principles of antenna radiation and how to direct and shape that radiation have been known for many years. Basic electrical designs have been developed, all of which perform well under proper applications. The application is important because we know that best performance always can be obtained when the design covers a specific purpose. An antenna which must cover a wide band of frequencies cannot be designed to have as much gain or as low a standing wave ratio as one which must cover only a relatively narrow band.

Above all, the electrical design must be selected which will best complement the mechanical design. There is little point in reaching for high gain performance if it will be short lived by certain early failure due to mechanical limitations inherent in the design. In the most simple terms, this means that a good antenna should work well and live long.

High gain antennas and arrays can be as reliable as simple half-wave antennas if proper attention is given to the mechanical design. A good mechanical design should have the following characteristics:

1. *A high strength-to-weight ratio.* Materials and construction should be used which will withstand the force and stress of maximum wind velocities and ice loading to be expected. Light weight means less tower loading and easier erection.

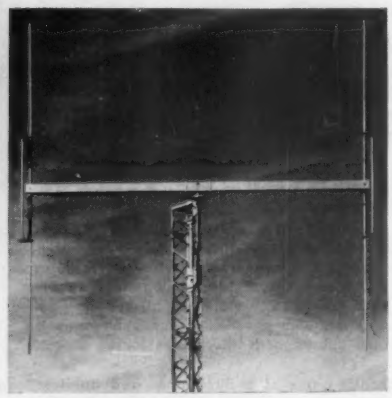
2. Materials which are resistant to the effects of weathering, corrosion, and electrolysis. This applies to the antenna elements, insulation, hardware and mountings. To avoid electrolytic corrosion, metals of widely varying chemical potentials should not be used in direct contact.

3. Insulation should be used only where necessary and then not between high voltage points. It is also desirable to avoid the use of insulating materials at points of high mechanical stress.

4. Plugging of tubular elements to lessen vibration fatigue and fastenings which will not loosen with wind vibration. The small but constant force of wind vibration can be just as damaging as a hurricane if precautions are not taken.

Directive and special purpose antennas are now commercially available which have the mechanical and electrical reliability of the simpler dipole antennas commonly used. This makes it possible for system planning engineers to use the techniques of the broadcast service where the radiation is directed and patterned to where it counts—and pays. In the mobile service it pays in terms of improved coverage, shorter towers, and reduced interference to adjacent stations.

With a better understanding of their application, it is believed that such antennas will be increasingly used to help meet today's and tomorrow's requirements in two-way radio communications. —30—



Bi-directional array for 30-50 mc. Terminating impedance is 50 ohms. Gain is 4 db over dipole in each maximum lobe. Gives nearly rectangular range pattern. Ideal for right-of-way systems such as pipe lines, highways, railroads, rivers. Antenna consists of 2 half wave vertical dipoles separated by half wavelength and fed in phase.

Bureau of Standards Role in IGY

One of two radio telescopes near Boulder, Colorado, operated by National Bureau of Standards.

Results will provide valuable information in fields of meteorology and radio communications.

THE NATIONAL Bureau of Standards is playing an active, many-faceted role in the International Geophysical Year of 1957-58. From observation stations widely scattered over the globe, the Bureau is collecting and analyzing data on many phases of upper atmospheric physics and radio propagation. Centered in the Boulder (Colo.) Laboratories, where most NBS radio propagation research is carried on, the Bureau's part in the program includes studies of the ionosphere, forward scatter propagation, various kinds of radio noise, airglow, and related phenomena.

The greatest part of the Bureau's effort will be concerned with variations in the ionosphere. Because of its extensive studies along these lines, the Bureau has been given responsibility for the ionospheric data program in the Western Hemisphere. As part of this phase, the study of sporadic-E propagation will be intensified through the operation of controlled circuits.

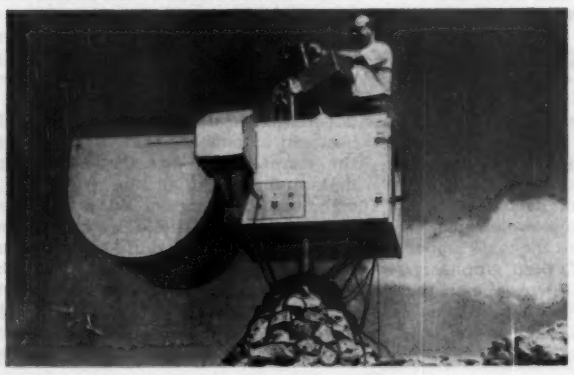
In cooperation with several South American laboratories, research will be conducted into ionospheric forward scatter in the equatorial region. Further investigation of scatter will be made in the Caribbean in cooperation with the Navy and in the Far East in conjunction with the "Voice of America" and the Japanese Radio Research Labs.

The Bureau is also expected to learn more about radio interference and propagation through a study of radio noise. Sixteen world-wide noise-observation stations have been set up.

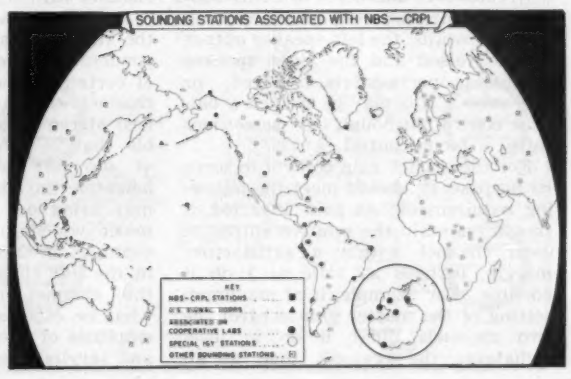
In addition, a systematic recording and study of airglow, a faint night-sky luminescence, will be undertaken with telescopic photometers. Two airglow observing stations have been set up and photometers have been supplied to others in the American chain of 13 stations.

Focal point of the day-to-day system for observation coordination is the Bureau's radio forecasting center near Washington. From this nerve center, warnings are flashed to scientists throughout the world for special conditions of observation. —50—

Sensitive photoelectric photometer used to observe airglow.

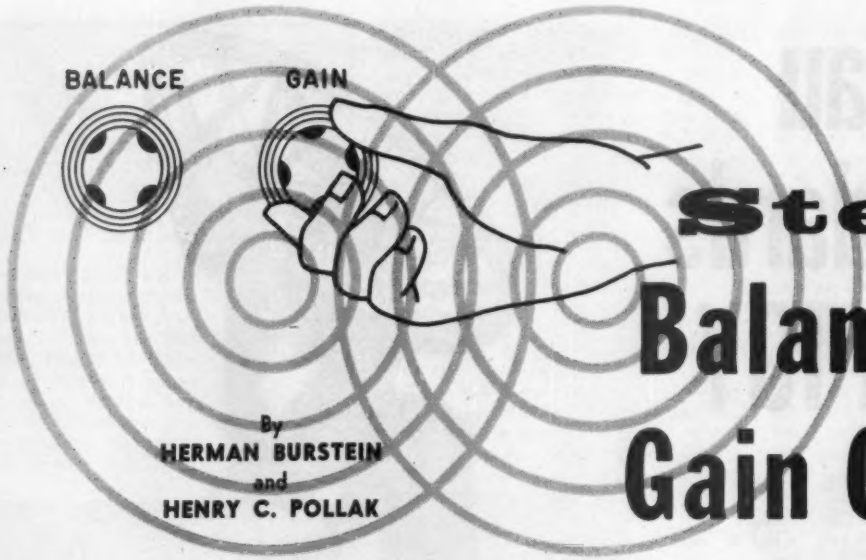


Special sounding stations set up for the IGY observations.



ones. Resistors R_1 and R_2 are about

2 units, there is a total difference of



Stereo Balance and Gain Control

By
HERMAN BURSTEIN
and
HENRY C. POLLAK

How to install and adjust the important controls that equalize and determine gain of stereo sound channels.

WHEN adding a second audio channel in order to enjoy the benefits of stereo sound—either from tape or from a joint FM-AM broadcast—one runs into a new problem area which concerns the amplitude relationship between the output of each channel. "Output" refers here to the level of sound emanating from each speaker system.

Of course each channel can be controlled individually as far as output level is concerned and with care one can obtain quite satisfactory balance of sound. However, such a procedure means that every time one plays stereo, for every change in gain, and quite possibly for different stereo sources, one must redetermine the points of best balance on the individual gain controls of the two channels. This situation is neither ideal nor workmanlike.

Preferably the stereo setup should be equipped with two controls that operate as follows: 1. A master gain control that simultaneously governs both channels, and 2. A control which changes the output level of each channel relative to the other without substantially altering their combined level. In other words, the left speaker output can be raised and the right speaker output proportionately reduced; or *vice versa*. This may be termed a balance control, although it is sometimes called a focus control.

For the master gain control to serve its purpose, it should meet the following requirement: As gain is varied, it should maintain the relative output of each channel within a satisfactory margin, perhaps as little as 1 db if possible. For example, if at maximum setting of the master gain control the two channels differ 6 db in level (whatever the reason), then at all other settings of the control the output levels should remain between 5 and 7 db of each other.

The balance control should meet the following two requirements: 1. It should be mounted with a numbered dial so that the user can readily return to points of balance that he has found suitable for various stereo sources, and 2. Equal output from the two channels should be obtained at a point in the middle of the dial.

Several reasons exist for a balance control, although, as will be discussed later, exact balance between the two channels can be obtained by proper adjustments within each channel. For one thing, this exact balance can easily be upset by such factors as the aging or replacement of tubes and other components. Just as important is the fact that stereo tapes do not always maintain equal level on the two channels, assuming that equal level is the most desirable condition. Thus the user may well find that on some tapes or other stereo program material he obtains the best stereo by restoring equal output on each channel with the balance control.

It must be further considered that the stereo art still contains many imponderables, one of which is the lack of certainty that equal level on each channel will, in all cases, provide the best stereo illusion. It is quite possible that in some instances emphasis of the left or right channel may heighten the stereo illusion. Or this may bring out certain facets of the music which are most pleasing. For example, if most of the bass appears in the left channel, then emphasis of this channel may give the listener what he especially desires. Moreover, emphasis of one channel or the other, and varying degrees of emphasis, may produce different effects in one room than in another.

Finally, it should be taken into account that, at least today, the stereo listener can count himself within the ranks of experimenters and a balance control gives him something with which to experiment.

A suitable gain-balance circuit is shown in Fig. 3A. Essentially it is based upon that found in the *Bell* binaural amplifier, Model 3DT.

It may be seen in Fig. 3A that the dual balance control pots are connected so that as the resistance of one increases, the resistance of the other decreases. Each channel may be varied over a range of 10 db. Theoretically, it would be desirable for mid-setting of the pot to represent a 5 db loss, so that turning the pot to either extreme would add or subtract 5 db. This, however, would require a special taper. A linear pot is satisfactory, with mid-setting representing a 6 db loss.

Dual control pots operated by a single shaft are available from most manufacturers of potentiometers. In the case of the *IRC* line, which permits great flexibility of pot combinations, the second pot comes separately without a shaft and is attached in "piggy-back" fashion to the first in a matter of moments, in a manner similar to that in which a line switch may be attached to a volume control.

Depending upon how fortunate one is in obtaining matched pots, the master gain control arrangement shown in Fig. 3A may result in a deviation of as much as 4 or 5 db between channels; that is, assuming the channels are exactly matched at maximum setting of the two pots, a significant mismatch can occur at lower settings. Although the balance control can take care of this deviation, one may improve the tracking of the master gain control sections by using the arrangement shown in Fig. 3B, using 500,000-ohm center-tapped pots rather than 250,000-ohm untapped

ones. Resistors R_1 and R_2 are about 20,000 ohms, the exact value of one of these being empirically selected for best tracking.

Improved tracking is obtained as follows. Obviously the two pots are in exact agreement at maximum rotation and minimum rotation. If they are also in exact agreement at some appropriately chosen intermediate point, then tracking will be essentially good throughout the range. A value of about 20,000 ohms compared with 250,000 ohms (where the tap is located) represents a reduction somewhat above 20 db. Since the range within which a pot is ordinarily used is about 40 db, this means that exact tracking occurs roughly midway in the range.

Whether one owns an integrated control-power amplifier or separate control amplifier and power amplifier, the logical place to put the balance and master gain controls is between the stereo source and the control amplifier. This assumes that the stereo source furnishes a high level signal, on the order of .5 volt (peaks) or more, which is almost always the case. Thus a tape recorder preamplifier usually puts out a signal of .5 volt or more, as do FM and AM tuners in general.

One might place the balance and gain controls between the control amplifiers and power amplifiers. But this has the disadvantage of causing the control amplifier to work harder than it has to. The relationship between the values of the balance and gain pots in Fig. 3A is such that there is a loss of 6 db per channel at mid-setting of the balance control. As a result, if the balance and gain controls were placed after the control amplifier, the latter would have to produce roughly twice as much voltage, which might of course contain increased distortion, quite possibly a substantial increase.

Fig. 1 shows a balance control circuit requiring only one potentiometer. However, the dual gain control would then have to be located at a different stage.

Balancing the Channels

As shown in Fig. 3A, there is about 10 db maximum loss within each channel. Unless the audiophile uses fairly identical speaker systems, power amplifiers, and control amplifiers, it is very easy for the difference in output between the channels to exceed 10 db by a considerable margin, so that the balance control, even at its extreme range, cannot achieve balance.

For example, assume that on channel 1 the following is true: control amplifier delivers 1 volt for .1 volt input; power amplifier delivers 50 watts for 1 volt input; speaker efficiency is 8%. And assume that on channel 2 the following is true: control amplifier delivers .5 volt for .1 volt input; power amplifier delivers 12.5 watts for 1 volt input (or 3.125 watts for .5 volt input); speaker efficiency is 2%. As a result of these differences between the channel 1 and 2 units, there is a total difference of 18 db between their respective outputs, assuming equal input to each channel.

Consequently, unless the components of each channel are matched to a fairly close degree, it is necessary to take appropriate measures so that equal inputs to each channel produce more or less equal output from each speaker system.

If speakers of different efficiency are employed as well as power amplifiers of different wattage rating, it is usually advisable as a first step to use the more efficient speaker with the lower wattage amplifier. If the user is in doubt as to which is the more efficient speaker, he has only to place them, at the proper terminals, alternately across one of the power amplifiers as a signal (radio, phono, tape, etc.) is fed in. If his ears do not detect a perceptible difference in level, he may assume that their efficiencies are reasonably similar.

If the speakers are of similar efficiency, the problem of matching components then boils down to matching control amplifier to power amplifier on each channel, so that equal input to the control amplifier will result in equal output from the power amplifier. This, of course, means taking into account the sensitivities of the four units involved. In the example cited at the opening of this section, it would be desirable to switch control amplifiers between the two channels. Now on channel 2 the control amplifier would have twice the sensitivity of the one on channel 1, thus compensating for the fact that the power amplifier on channel 2 has only half the sensitivity of that on the other channel. Remember, however, that it is now assumed the speakers have the same efficiencies, more or less.

Let us restore all the conditions of the original example, which means that one speaker system has 6 db more output than the other, the same being true for the control amplifiers and the power amplifiers. Now how would one go about achieving balance? To begin with, the 50-watt amplifier which, on the basis of the data in the example, also has twice as much sensitivity (12.5 watts for .5 volt input), would be coupled with the less efficient speaker. Thus each power amplifier-speaker combination would be balanced. It would remain then to balance the control units. This could be done by reducing signal either at the input or output of the more sensitive control unit. If the signal is reduced at the output, this has the possible disadvantage of significantly raising distortion in the control amplifier output because the control amplifier has to work that much harder for the same signal reaching the power amplifier. If the signal is reduced at the input, this has the possible disadvantage that there is not only greater amplification of the signal but also greater amplification of noise generated within the control amplifier. The eventual choice depends upon the individual control unit.

How can input signal to the control amplifier be conveniently reduced? Many control units contain input level potentiometers for high level signals, which can be adjusted in accordance with the user's needs. If not, such a potentiometer can be installed, as illustrated in Fig. 2.

How can the output signal from the control amplifier be conveniently reduced? Many power amplifiers con-

(*Continued on page* 106)

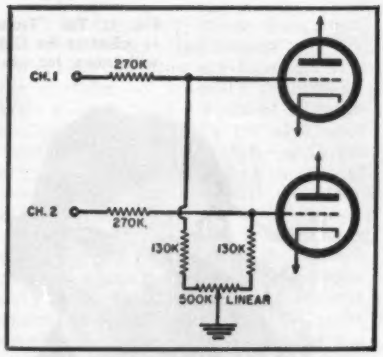


Fig. 1. Method of achieving balance.

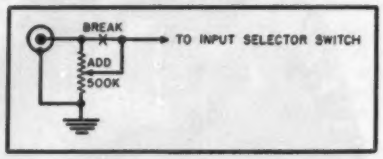


Fig. 2. Adding an input potentiometer.

Fig. 3. (A) Gain and balance controls for system. (B) Improved tracking version.

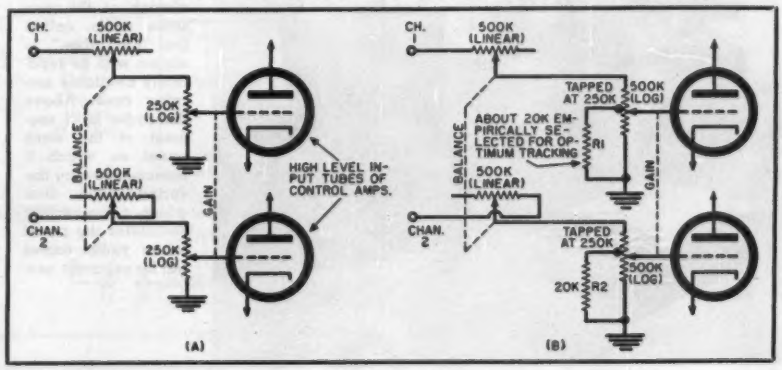
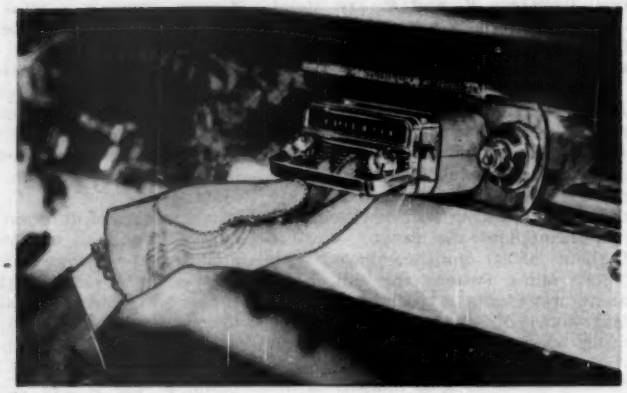


Fig. 1. The "Trans-Portable," as it is called in the Oldsmobile, is easily withdrawn for use outside the car.



Delco's Portable Auto Radio

A truly convertible, transistorized auto receiver instantly becomes a hand-held, lightweight set.

DID SOMEBODY forget to bring along the radio on that family drive and picnic? Or did you just decide that you weren't going to add one more item to that mountain of miscellaneous equipment you had to pack and keep track of on the trip?

If you happen to own a 1958 *Oldsmobile* or *Pontiac*, you don't have to worry about missing your favorite programs. You just pull a lever in the glove compartment and a slender, lightweight portable—the heart of your auto radio—slips out of the dash panel and into your hand for use on the beach, in the park, or at home.

Taking advantage of transistor circuitry and some tricky, automatic switching, design engineers of *General Motors' Delco Radio Division* have come up with the "Trans-Portable," as *Oldsmobile* calls it, or the "Sportable," as it is known by *Pontiac*. Virtually two radios in one, rather than a single radio, this optional accessory features a ten-transistor circuit, operating from the vehicle's power supply, to provide up to six watts of audio output through two 6"x9" speakers.

However, much of this changes when you reach into the glove compartment to pull the release lever which frees the portable. As you slide the radio into your hand (Fig. 1), a 10-terminal connector mounted at the rear of the portable unit, which includes automatic switching of several connections, goes to work. As a result, you wind up with a 9-transistor portable, with an integral 3-inch speaker, that operates from its own 6-volt supply, derived from four integral penlite or mercury batteries. As the radio is pulled out, a chrome door that blends with dashboard styling springs down and covers the opening. The *Pontiac* version of the radio, the "Sportable," is shown in Fig. 2, along with the section of the dash panel from which it has been removed and a separately available carrying case. Note that two controls flanking the radio on the dash, the tone control and the two-speaker fader control, remain in the auto. The latter is in the circuit of the additional audio-output transistor, a 2N278, which drives the two oval speakers and is itself powered by the 12-volt car battery.

Fig. 2. The Pontiac version of the versatile radio, called the "Sportable," is shown with its separately available carrying case. Above the radio is a segment of the dash panel on which it mounts, showing the spring-loaded door which automatically completes the panel when radio comes out for separate use.

Those portions of the radio circuit that remain in the car when the portable portion is withdrawn are included within the broken lines at the lower center portion of the schematic of Fig. 3. Most obvious item to remain in the car is the conventional auto antenna. As shown at the bottom of Fig. 3, it has its own tuning capacitor which remains with it, and it feeds signal through connection *X* into the r.f. amplifier, a 2N150 transistor, at the upper left of the schematic. Out of the car, the radio loses this antenna, with switch S_{1B} throwing in the high-"*Q*"

ferrite-type loop antenna coil. The latter is tuned by a variable ganged tuning capacitor, while the external antenna is peaked with a slug-tuned coil.

The r.f. stage itself, a rarity indeed in transistor portables, contributes low noise level and excellent image rejection. Another slug-tuned coil accomplishes the tuning of the r.f. stage. A separate oscillator stage—another rarity for a transistor portable—appears just below the r.f. stage in the schematic. This temperature-conpensated circuit tunes to 262 kc. above the incoming signal.

From the mixer, the 2N149 to the right of the r.f. stage, the 262-kc. difference frequency is fed to the two transistor i.f. stages and three associated i.f. transformers. The transformers provide high sensitivity. The possibility of annoying images with this low intermediate frequency is suppressed by the use of an r.f. amplifier; in the meantime use of this relatively low frequency enables the realization of an exceptional amount of gain in the i.f. strip. Output from the final i.f. amplifier, designated as R62, is supplied to two circuits by way of the last i.f. transformer.

One winding of the transformer feeds the 1N295 crystal detector shown just below the transformer. This in turn feeds the separate a.g.c. amplifier, a transistor designated as R64. The stage permits the tight control of audio level so desirable in an auto radio and so exceptional for a portable. Output from this stage controls the r.f. amplifier and 1st i.f. stage.

Another crystal detector, just to the right of the last i.f. transformer, feeds the 1st audio amplifier at the extreme upper right. This is a 2N217 transistor in a class-A circuit. It is then transformer-coupled to a class B, push-pull output circuit, shown at the lower right of Fig. 3 and consisting of two 2N217's, which drive the 3-inch speaker in the portable through an output transformer.

When the radio is plugged into the dash panel, contacts *B* and *C* of switch S_1 disconnect the 3-inch speaker. Instead, output is fed from the secondary of the output transformer, through the 10-connector terminal board, into a final 2N278 audio amplifier. This added amplification provides the power output requirement for use in a vehicle.

To obtain this extra power, the transistor is operated from 12 volts. This is accomplished by having switch S_2 disconnect the 6-volt supply derived from batteries in the portable portion and by bringing in, through the connector strip, 12 volts from the car supply. This operates the 2N278 after passing through the filter circuit shown in the block of components that remains in the car. This supply also passes through a voltage divider, also shown in the block, whose 6-volt output is fed to all other stages.

Mercury batteries are supplied with the portable as standard equipment. With a total current drain of 10 milliamperes for the entire portable unit, battery life is reported to be up to 160 hours. The mercury batteries, of course, are replaceable with four penlite cells.

The tone control, also remaining in the car, is brought into the circuit through contact *L* on the connector strip, entering between the volume control and the base of the first audio amplifier. The portable section of the receiver, like conventional miniaturized transistor portables, makes extentive use of printed wiring.

The notion of developing a radio with a dual personality, so that it could double as auto radio and portable, is not recent. However, the power-supply requirements involved with the use of vacuum tubes, while not presenting an insurmountable obstacle, made fulfillment of the idea rather impractical. The growing use of transistors in radio design gave *Delco Radio* engineers the opportunity to come up with this significant achievement for the car owner who wants the convenience provided by the versatile, twin-role receiver.

Delco Radio was also responsible for the first all-transistor auto radio, featured in the August 1957 issue of this magazine. -30-

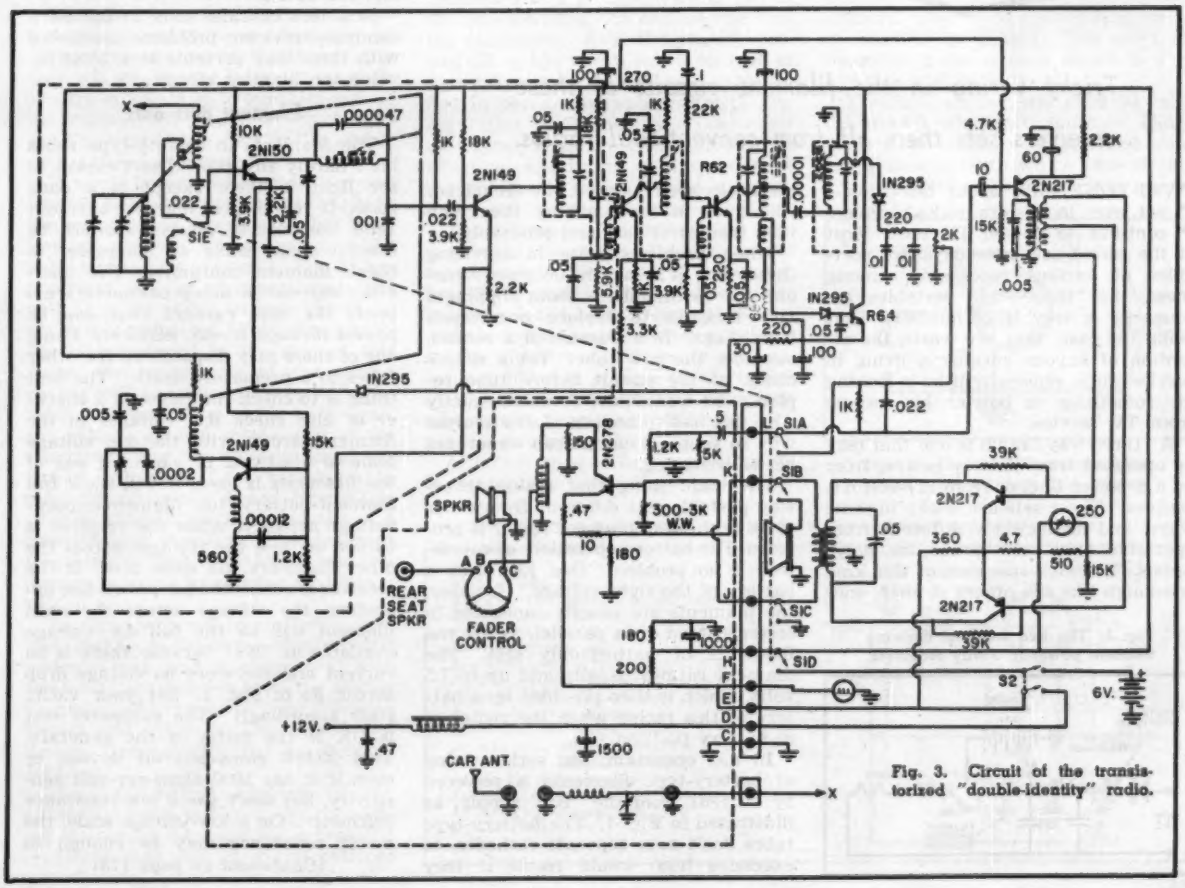
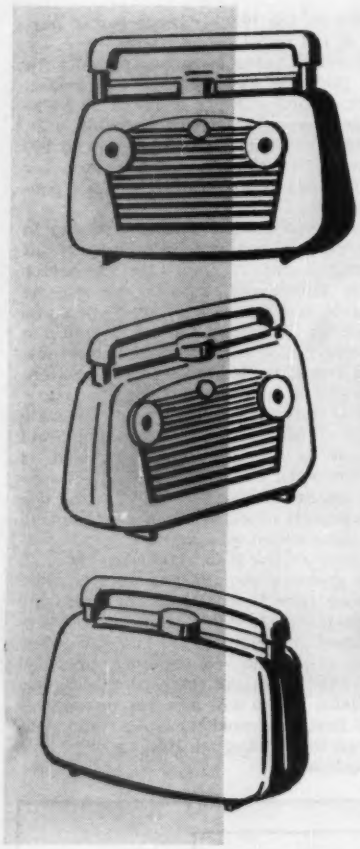


Fig. 3. Circuit of the transistorized "double-identity" radio.



Servicing Three-Way AM Radios

By J. RICHARD JOHNSON

Tricky wiring in the filament circuits of these receivers sets them off from conventional radios.

EVERYONE talks about television—yet, even in this era, radio receivers continue to outsell TV sets. Most of the radios sold nowadays are portables of various types and, among these, the "three-way" portables account for a very large number. That being the case, they are worth the attention of anyone earning a living in service work, especially if he is looking for something to bolster his income from TV service.

A "three-way" radio is one that may be operated from battery power, from an a.c. power line, or from 117-volt d.c. sources. These sets are tricky in some ways, and distinctively different from "portable only" or "power-line only" radios. Yet each specimen of this kind is enough like the others so that, once the tricks are mastered, the technician who goes in for handling them can turn them over fast and profitably.

When problems arise in servicing these sets, it's usually because someone was too impulsive about slipping a new tube in to replace one which burned out. In a fraction of a second, out goes the new tube! Yet a simple check of the circuit *before* tube replacement would have revealed exactly why this had to happen. Let's analyze why so simple a circuit can sometimes be so irritating.

The main thing that makes three-way portable sets different from other types is the way filament power is provided. For battery operation, of course, there's no problem. One just uses a battery of the right voltage. However, the filaments are usually connected in *series* instead of in parallel, as are the filaments of battery-only sets. The filament ratings usually add up to 7.5 volts, which is then provided by a battery of this rating when the switch is in battery position.

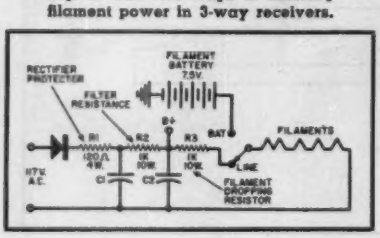
In a.c. operation, the series string of battery-type filaments is powered by current from the "B+" supply, as illustrated in Fig. 1. The battery-type tubes don't have separate cathodes, so excessive hum would result if they were powered by alternating current. Therefore, current for the filament string is obtained from the same rectifier that rectifies power line current for the "B" supply.

Since the current rating of the filaments of the tubes employed is ordinarily 50 ma., a vacuum-tube rectifier or a selenium rectifier can supply direct current for both the filament and the plate and screen circuits of the receiver. A dropping resistor limits filament current to the desired 50 ma. Any parallel connection would require so much more current that the ratings of ordinary low-power rectifiers would be exceeded. This is why the heaters are connected in series for a.c. operation. Once they are so connected, they are kept in series for battery operation simply to eliminate the need for switching in the filament circuit when changing from one mode of operation to the other.

Most three-way portables now use selenium rectifiers. When vacuum-tube rectifiers are used, they also have filaments that require power; however, these are a.c.-type filaments, and their current doesn't need to be rectified. The filament ratings are usually 50, 70, or 117 volts and they are supplied from the power line through dropping resistors (except for the 117-volt tube, whose filament can be connected directly across the power line). Examples of such rectifiers are the 50Y6 and the 117Z6.

Now let's consider some of the more common servicing problems connected with three-way portable sets. Most involve the filament circuit.

Fig. 1. The two ways of deriving filament power in 3-way receivers.



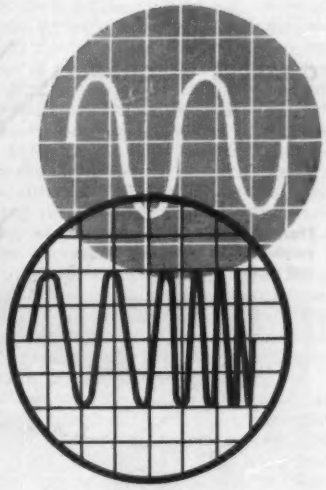
Filament Burn-outs

The filaments in battery-type tubes have hardly any glow. Don't expect to see light in them except in a dark room. If you suspect filament burn-out (and you nearly always should) be careful about using an ohmmeter to check filament continuity. *The operating current in many ohmmeters exceeds the safe current that can be passed through 50-ma. filaments.* Using one of these may dispatch all the other tubes to a premature death! The best thing is to check the tubes on a checker or else check d.c. voltages in the filament circuit with the d.c. voltage scale of a v.t.v.m. or v.o.m. If one of the filaments is open, it will show full filament-battery (or filament-supply) voltage across it when the receiver is turned on, and the voltages across the other filaments will show zero. If the receiver is connected for power-line operation, the voltage across the open filament will be the full d.c. voltage available as "B+" because there is no current and therefore no voltage drop across R_3 in Fig. 1. Set your v.o.m. scale accordingly. The voltmeter test is OK if the meter is the generally used 20,000 ohms-per-volt device, or even if it has 1000 ohms-per-volt sensitivity, but *don't use a low-resistance voltmeter.* On a low-voltage scale, the meter resistance may be enough to

(*Continued on page* 178)

Get Sweep From Your Signal Generator

Fig. 1. The completed sweep-output adapter fits into a compact housing.



By **KUNG YAO**

A single-stage circuit may be added to a standard sine-wave oscillator to produce a usable sweep.

HOW MANY times have owners of standard signal generators used their instruments to align FM or wide-band i.f. amplifiers with results that are less than satisfactory? A problem exists here particularly in the case of the AM circuits for, even where a sweep generator designed for service-shop use is available, these instruments never go down as far as the AM range.

Described here is a method of constructing an inexpensive adapter or accessory for any conventional oscillator that will enable the latter to generate spectra or bands of frequencies around the nominal frequency to which it is set. The working element in this simple unit is the reactance tube.

It would be somewhat irrelevant and lengthy to go into the minute details of the operation of reactance tubes here. For our purpose, we can say that the output of the basic circuit (Fig. 2) has a certain amount of capacitance that will have an effect on any circuit to which it is connected. When an a.c. voltage is introduced to the grid of this stage, the capacitance of the output circuit will be varied in step with the input voltage. Thus, with a 60-cycle a.c. voltage applied to the grid of the reactance stage, the capacitance at the output will vary from maximum to minimum 60 times a second. Now if this varying capacitance is placed across a tuned circuit, it will vary the resonant frequency of that circuit from one frequency extreme to another 60 times a second.

To those who are interested in further details on reactance-tube circuits and who may wish to experiment with the final circuit shown here, the author suggests "Electronics," by Thomas Brown and "How to Use Signal and Sweep Generators," by J. Richard Johnson.

The final circuit adopted by the author is shown in Fig. 3. By connecting its output (J_1 and J_2) across the oscillator tank coil of a conventional signal generator, usable bands of frequencies are produced at several frequencies of interest. In addition to the reactance circuit for providing sweep, there is also a phase-adjusting circuit for synchronizing the oscilloscope during alignment. R_5 is the phasing control. R_1 is the sweep width control, or sweep frequency control, as it is identified in the photograph of Fig. 1. By regulating the amplitude of the input a.c. signal, it controls the variation in effective capacitance at the output of the reactance circuit. Thus it determines how wide a band may be swept.

The components are not critical with respect to tolerance. Junk-box parts may be used. The value of R_2 has not been fixed exactly. This is because it has been found best to use a 1000-ohm resistor in this position when operation in the vicinity of 455 kc. is desired, while a 100-ohm resistor works better at 10.7 mc. A potentiometer or switch selection of resistors could be used to provide maximum flexibility.

Although no specific layout of parts is mandatory, all wires and leads should be kept as neat and short as possible and the rules governing good lead dress should be observed because this adapter is going to be used with another unit to function at r.f. The author's unit was constructed on a chassis 5⅛" by 4" by 1". This was then mounted in the cabinet shown in Fig. 1, which is 6" by 5" by 4".

The finished unit will need 90 volts d.c. and 6.3 volts a.c. to function. Quite likely these voltages can be taken from the generator with which this circuit

(*Continued on page* 137)

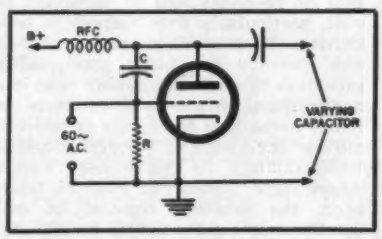
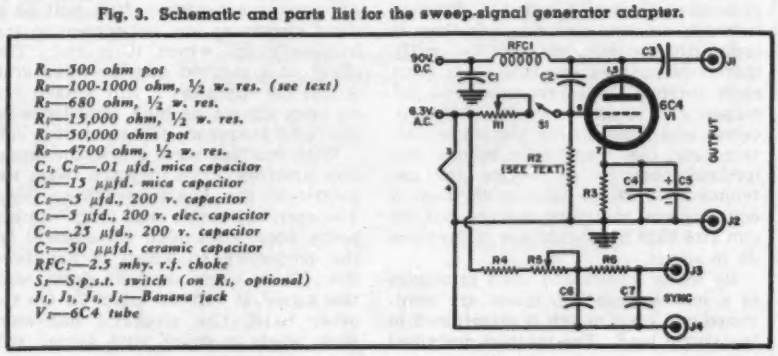


Fig. 2. The basic reactance-tube circuit used for providing sweep.

Fig. 3. Schematic and parts list for the sweep-signal generator adapter.



Three Antennas on One Lead

By
CHARLES WOODARD

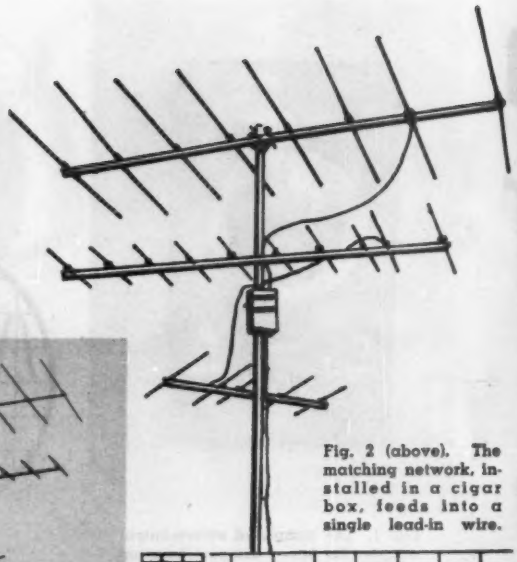


Fig. 1 (below). Each of the 3 yagis had its own lead before use of the "electronic switch."

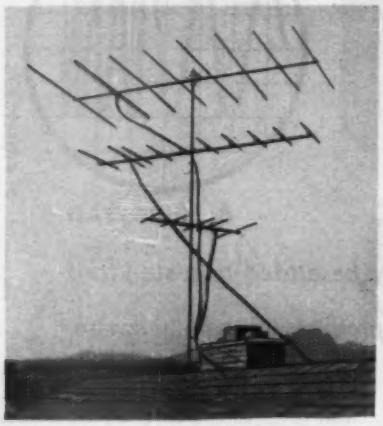


Fig. 2 (above). The matching network, installed in a cigar box, feeds into a single lead-in wire.

Multiple-antenna fringe installations can be matched to one transmisson line efficiently

OVER YEARS of development in television, remarkable improvements have been chalked up in the design of receivers and of antennas as well, particularly with respect to sensitivity. With modern receivers, it is now possible to obtain good-quality reception through using more than one narrow-band high-gain antenna in fringe areas that were once considered outside the range of the transmitters. Unfortunately, in these very areas where signal losses can least be tolerated, the problem remains of efficiently coupling the dearly bought signal from the antenna to the receiver without dissipating part of it.

Since fringe-antenna installations generally involve a greater distance between antenna and receiver than is ordinarily the case, there is the costly matter of running separate leads from each antenna to the receiver, and the nuisance of having to switch at the receiver end from one to the other. Alternately, one could save money and inconvenience by connecting the antennas to a single lead-in through a coupling and matching device—but we run into that inevitable loss of precious db in signal.

By using known and tried principles in a new application, losses are minimized and good match is maintained in the single lead. The method described here was applied to an installation involving three single-channel yagis (Channels 6, 8, and 13) which were originally brought down to the receiver through three separate transmission lines, as shown in Fig. 1. In fact, due to transformer action provided by the added stubs, signal may be boosted in some cases.

Before going into details on the switch, the elements that make it up are worth discussion. Since these elements are both quarter-wave and half-wave stubs made of 300-ohm transmission line, a review of their action is important.

A quarter-wave stub can be either open (Fig. 3A) or shorted (Fig. 3B). An open quarter-wave stub will be a short circuit or low impedance to the frequency for which it is cut. The effect of a shorted quarter-wave stub is just the opposite: it will behave like an open circuit or high impedance to the radio frequency for which it is cut.

With the half-wave stubs, the situation reverses, since they are twice the length of the quarter-wave sections. The open half-wave stub (Fig. 4A) appears open (has high impedance) at the frequency to which it has been cut. Thus, when used in shunt with this signal, it will not affect it. On the other hand, the shorted half-wave stub, when in shunt with signal, will have low impedance and short out this signal. The detailed whys and hows of this theory can be found in any reference on antenna theory; the simple statement of the type of action to be expected is sufficient for the scope of this article.

While the principle applied here could be used for combinations involving more than three antennas, an illustration involving that number will provide the basic understanding of how connections are made. The complete matching array is shown in Fig. 8. For analysis, only one section of that array, the portion belonging to the low-frequency antenna, will be studied. This is shown in Fig. 5. To follow the terminology used, note that the line between each antenna and the common down-lead is called the *leg*, as in Fig 6. The stubs that run perpendicular to the legs are called *leaves*.

Looking at the low-frequency leg of Fig. 5, note that each leaf is cut to be a quarter wavelength at the low frequency (*L*) and then shorted at the far end so that it will be an open circuit at the open end (see Editor's Note on page 157). The first leaf (shown to the right) is connected to the leg at a point which is a quarter wavelength of the high frequency (*H*) back from the junction point where all three legs connect. The open end of this leaf is spaced a quarter-wave of the high frequency from the leg.

The second leaf (to the left) is inserted at that point on the leg which is a quarter wavelength from the junction point at the middle frequency, *M*. It is spaced so that its open end is

a quarter wavelength from the leg at the middle frequency.

Now, when signal is picked up by the low-frequency antenna, the two shorted quarter-wave stubs in this leg of the matching system at that frequency, appearing as open circuits, permit low-frequency signal to pass on to the single transmission line unhindered. In essence, the other two legs are designed the same way for their respective frequencies. To get adequate length on some of the sections, however, some of them will have to be cut to odd multiples of quarter wavelengths, such as three-quarters of a wavelength, as shown in Fig. 8. These sections will essentially behave as though they were single quarter-wave lengths.

We have shown that signal from any one antenna is coupled to the common transmission line without hindrance by the stubs in its path; it remains to be seen what these stubs perform with respect to signals from the other antennas. Once more—this time using Fig. 8—let us follow signal along one of the legs. Choosing the mid-frequency leg, we note that signal will pass unhindered from the antenna to the junction point of all three legs. But how do the high-frequency and low-frequency legs act with respect to incoming mid-frequency signal? Starting at the junction point and proceeding along the high-frequency leg, we note a quarter-wave at the middle frequency before the first leaf is reached. The leaf itself adds another quarter-wave at the middle frequency, and this section of line is open at its farthest end. Altogether then we have half a wavelength at the middle frequency starting out from the junction point, and this total section is open at its end. It will therefore represent a high impedance to middle frequencies at the junction point, keeping them out of the high-frequency leg.

If we start again at the junction point and trace along the leg to the high-frequency antenna, we find another open half-wave section for the middle frequency. Thus signal from the mid-frequency antenna is blocked off from entering the legs of either of the other two antennas, and has no place else to go except for the transmission line to the receiver. Since the high impedances it sees in either of the other two legs do not load the line, impedance match is maintained. If the path is traced out for either of the other two antennas, it will be seen that the same condition exists for each: that is, each antenna's signal is blocked from feeding into the legs of the other antennas and has no place to go except to the receiver.

While the matching network illustrated is designed for three antennas, additional antennas could be added by installing another leg for each, and by connecting another leaf on each leg to tune out the undesired antennas.

On the practical side, when splicing the leaf onto the leg, peel out carefully the portion of insulation where the joint will be soldered, being wary not to cut any strands of wire. To help produce a neater and better electrical joint, use a little soldering paste and

(*Continued on page* 157)

Fig. 3. Quarter-wave open (A) and shorted (B) stubs.

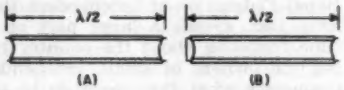


Fig. 4. Half-wave stubs of open (A) and shorted (B) line.

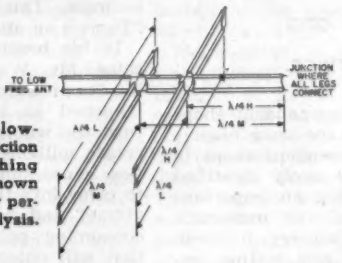


Fig. 5. The low-frequency section of the matching network, shown separately for performance analysis.

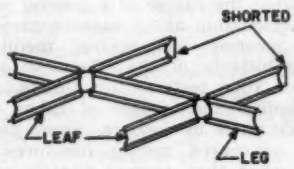


Fig. 6. Partial detail of the network, for establishing the terminology used here.

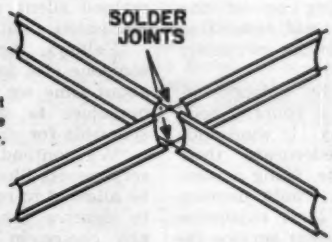
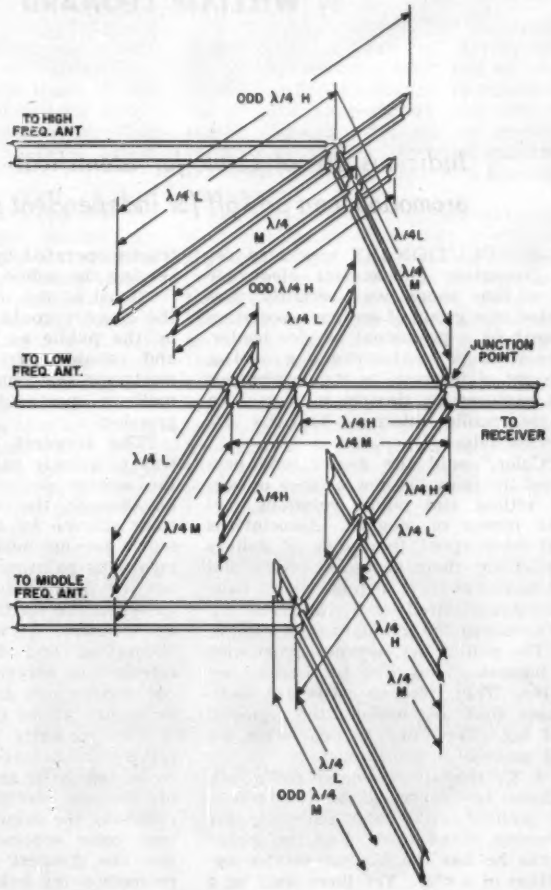


Fig. 7. Points at which lines are soldered together.

Fig. 8. The complete tuned network, or "electronic switch," for joining three antennas to a single transmission line.



The Magic of COLOR

By WILLIAM LEONARD

Judicious use of color, for identification and promotion, can pay off for independent service.

A REVOLUTIONARY new idea for promoting independent electronic service shops was recently presented to a group of service association officers by a prominent service leader. The idea is capturing a growing amount of interest, as its possibilities are explored by dealers interested in better public relations for the TV service industry.

"Color," said the dealer who proposed the plan, "is now a more powerful selling and public relations tool than names or slogans. Associations that have spent thousands of dollars publicizing their codes of ethics and the names of their member shops have been disappointed by the apparent indifference of the public to their efforts.

"The public has become accustomed to bigness. They like to shop in big stores. They like to patronize businesses that are well-lighted, colorful and big. They like to deal with big and successful companies.

"A TV manufacturer can put a half a dozen service trucks on the streets, all painted alike and carrying the company brand name, and the public thinks he has the biggest service operation in a city. Yet there may be a thousand or more service cars and trucks operated by independent shops serving the public in the same area.

"If all of the independent shops in the country could be easily identified by the public as being an important and capable part of the mammoth electronic servicing industry, it would make a spectacular and lasting impression.

"The simplest and most effective way to quickly gain this recognition," the service dealer continued, "would be through the use of an identical color scheme by all full-fledged electronic service businesses. This would mean the painting of the exteriors of our shops to conform to the accepted color pattern for the independent service industry. It would mean the redecorating and dressing up of the interiors of our shops, and repainting our service cars and trucks as rapidly as we can afford it.

"The majority of the independent service shops across the country need to be repainted anyway. If thousands of dealers would redecorate their places at the same time, using a common color scheme, it would develop into the greatest and least expensive promotion the independent service industry ever had."

One of the weaknesses of small businesses is that the owners often overlook the simple, relatively inexpensive things they can do to focus attention on and promote their businesses. The external and internal appearance of a business play an important part in winning and keeping customer interest. An attractively decorated shop leaves the impression that it is a successful business. People prefer to deal with successful businesses.

As the dealer quoted above said, color has become a way of life. People are getting more color-conscious all the time. They like to shop and live in colorful communities.

The average TV service shop is a drab-looking affair. Exteriors are weatherbeaten and forlorn. All too frequently they frame display windows that are dirty and filled with equipment in a confused state.

Yet these drab-looking, independent service shops are the headquarters for the men who are presumed to possess the advanced knowledge and technical skill necessary to service complex electronic equipment. Television, the miracle entertainment medium of all time, is maintained by a vast number of small businesses, most of which are bogged down in operating quarters that look like junk shops.

Ed Wimmer, vice-president and public relations director for the National Federation of Independent Business, Inc., spends a large part of his time traveling about the country telling the owners of small, independent businesses what they must do to stay in operation in competition with big business. This dynamic speaker says, "There's an answer in color."

In his brochure on the subject of color, Mr. Wimmer said, "If a real modernization program could be launched on a wide scale, it might turn the whole tide for independents; create millions of jobs and opportunities; cause more young people to want to come into their father's businesses; attract and hold the respect of the consuming public. Color is the key that will unlock the cineramic future for small business."

During the course of a general business discussion at an eastern association meeting last spring, members spoke bitterly of the effects of self-service tube testers, part-timers, and the indiscriminate sale of tubes and service parts by jobbers. Some members advocated strong measures to curb what they termed "unfair competition." One dealer, who had remained silent throughout the heated discussion, finally got the floor to say:

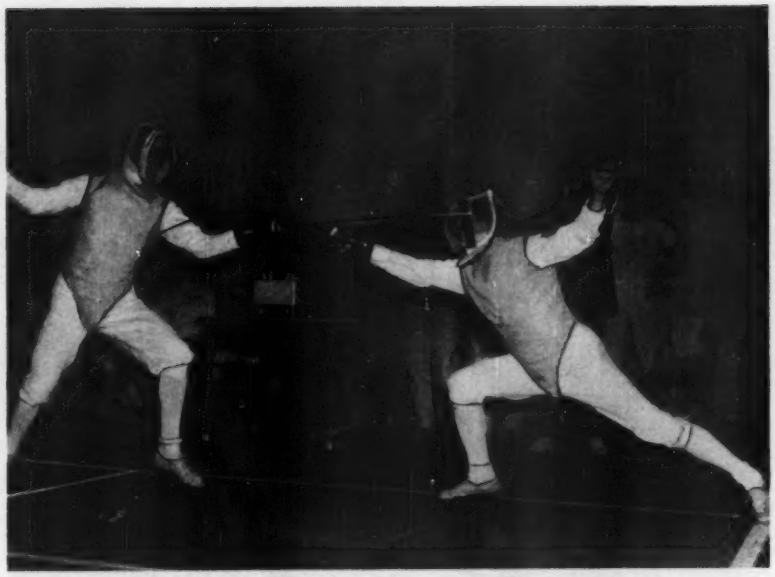
"Fellows, we are always blaming someone else for our troubles. Isn't it about time we took a critical look at ourselves to see if *we* are not responsible for most of them?

"We contend that only expert TV servicemen, like we claim to be, should be allowed to repair TV sets. We want to deprive the set-owning public of any choice in the matter and deny

(*Continued on page* 181)

To give one some idea of the speed

Electronic Fencing "Touche" Indicator



Members of the U. S. Olympic team demonstrate the electronic "touch" indicator during a bout at the U. S. Military Academy.

By **LEON A. WORTMAN**
Chairman, Electrical Weapons Committee
Amateur Fencers League of America

Unit designed to meet official international specs with unerring accuracy. Eliminates need for 4 judges.

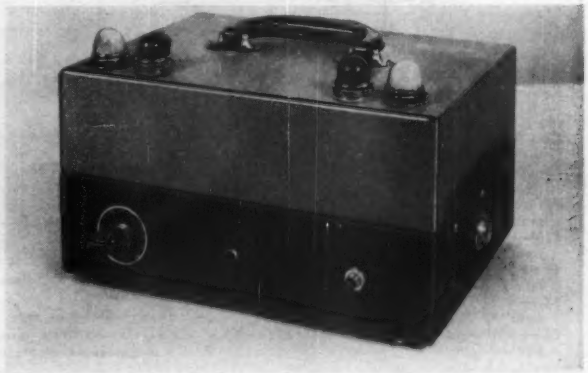
BELIEVE it or not, the ancient art of swordplay, fencing, has gone electronic. D'Artagnan and the Three Musketeers would raise a merry howl in protest, but in their time electronic apparatus attached to the combatants that would signal a "touch" wasn't necessary. Their weapons had sharp points and one knew exactly when and where a "touch" had been made.

When swordplay became a sport instead of a matter of life or death, the sharp points became illegal and the wire-mesh mask became mandatory for obvious reasons. Weapons became considerably lighter, too. These changes in armament enabled fencers to develop extraordinary speed and skills. It is often claimed by leading *masters of the sword* that D'Artagnan would flee in terror after encountering the intuition, guile, accuracy, and lightning-like speed of many of today's champions. So rapid can the execution of an attack be that the eye can miss it. The fencers themselves often find it difficult to know precisely whether or not a touch has been made or even where the point made the touch. To resolve this problem—in pre-electronic days—the "jury" was invented. This consists of five people who are familiar with the objectives of the game, four judges and a president.

Two judges are assigned to watch the body of each fencer. When a judge sees a touch he manually signals the president who "halts" the action. Each of the judges has a vote worth 1 point. Each must vote either "yes," "no," or "abstain" (meaning "not certain"). The trouble with this is that the judges often disagree as to the vote and as to where the point landed, "valid" or "invalid" target. The fencers are not allowed to vote or to influence the judges. The president has a vote worth 1½ points. He is in charge and must award or deny the touch on the basis of the vote count and his analysis of the rules-of-the-game as they pertain to the specific fencing action which caused the "halt."

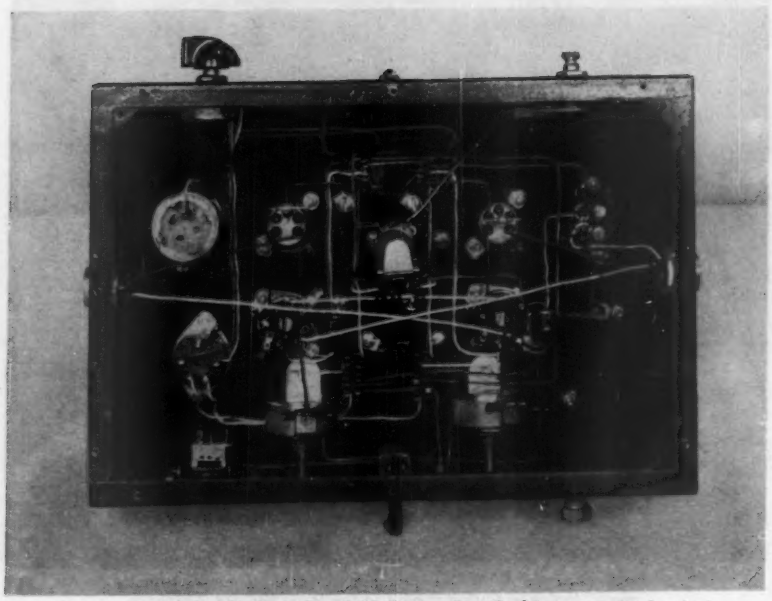
No member of the "jury" is free from human error. A moment's distraction or a bad light shadow can cause a judge to miss a touch, or make him "see" a touch. And, frankly speaking, there may be some personal prejudices with respect to the fencers. These human factors are a very serious problem for the sport at all levels including grammar school fencing and Olympic championship competitions. Electronics received an open invitation to solve the problem and, with a great measure of success, it has. Today, electrical fencing completely eliminates the need for the four judges and gives unerring accuracy. The president is now called a "director" during an electrically signalled bout and he retains his original authority to sanction the fencers' techniques. All voting power is now in the "hands" of electrical apparatus. Such electrical apparatus is now a familiar sight at a fencing tournament.

The performance requirements and electrical specifications used in official Olympic, World, and National Championships are drawn up by an international committee of experts. In May, 1957, this committee wrote a new set of regulations. (The complete regulations are rather lengthy. The author will supply them free of charge to anyone interested in the challenge of designing equipment which conforms to them. It is strongly recommended that one read and thoroughly understand them before starting to design such apparatus.)



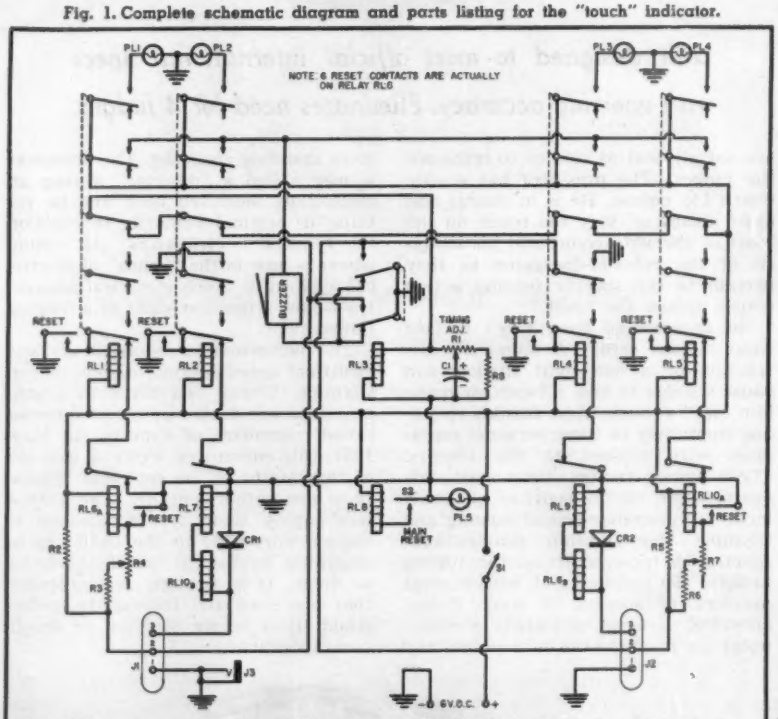
Over-all view of the unit. The four indicator lamps are on top of device, while the timer control, pilot lamp, and reset button may be seen on the front panel.

cables #1 wire is the mass of the weapon, #2 wire is the point, and #3



Bottom view of the electronic "touch" indicator described in accompanying text.

Fig. 1. Complete schematic diagram and parts listing for the "touch" indicator.



R_1—100 ohm, 2 w. pot ("Timing Adj.")
R_2, R_3—47 ohm, 2 w. res.
R_4, R_5—12 ohm, 1 w. res.
R_6, R_7—500 ohm, 2 w. pot
R_8—130 ohm, ½ w. res.
C_1—5000 μfd., 10 v. capacitor ("Timing")
J_1—3-pin receptacle for cable from "fencer-left"
J_2—3-pin receptacle for cable from "fencer-right"
J_3—Jack or clip for single wire to "neutral" ground mat
PL_1—White pilot light, #47 bulb ("Invalid-right")
PL_2—Green pilot light, #47 bulb ("Valid-left")
PL_3—Red pilot light, #47 bulb ("Valid-right")
PL_4—White pilot light, #47 bulb ("Invalid-left")
PL_5—Pilot light, #47 bulb, small jewel type
S_1—S.p.s.t. "on-off" toggle switch
S_2—S.p.s.t. spring-return switch ("Resetting Switch")
RL_1, RL_2, RL_3, RL_4—Fast-release telephone relay with "pile" of 4C and 1A contacts
RL_5—D.p.d.t., 500 ohm @ 9 ma. coil timer circuit relay (Iron Fireman R-400)
RL_6, RL_{10}—Sensitive relay to actuate "invalid" signaling circuit (Sigma 5J0100, see text)
RL_7, RL_8—Sensitive relay to actuate "valid" signaling circuit (Sigma 5RJ100)
RL_9—Six-pole, s.t. normally open relay, 6 volt d.c. coil
Buzzer—Doorbell type, insulated from chassis
CR_1, CR_2—1N56A germanium rectifier (inductive kickback suppressor)

To give one some idea of the speed capabilities of the foil, the apparatus must signal a touch when a weapon's point lands on the opponent for a time as brief as 5 milliseconds. Many designs fail to meet or even approach this speed requirement. The equipment must receive its power from storage batteries of 6, 12, or 24 volts at the discretion of the designer. No high voltages are allowed. This is for the safety of the fencers and for good voltage regulation. Fencers use foils with spring-loaded plunger-type points. This point is permanently connected to a wire lying in a groove in the blade and terminating at a two-prong plug at the handle. The blade itself constitutes the second wire of the closed electrical circuit and terminates at the second prong of the two-prong plug. When the point is at rest it contacts the blade and forms a normally closed circuit. Depressing the point opens the circuit.

The fencers' bodies are divided into areas of "valid" and "invalid" target. These are shown in Fig. 2. Fencers wear jackets made with highly conductive metallic threads and tailored to constitute the "valid" area. This jacket and the weapon are connected to the touch-signalling apparatus through a spring-loaded reel of highly-flexible, lightweight 3-wire cable. The spring tension is adjusted to permit complete maneuverability.

When the point of the weapon "sticks" the opponent on "invalid" target (non-conducting) the electrical circuit is interrupted and a white light and a buzzer go on. When the point "sticks" "valid" target (conducting metallic-jacket) a colored light and the buzzer go on. From an electrical standpoint, consider the action similar to a make-before-break single-pole double-throw switch. Consider, too, some of these complexities. Signalling a "valid" touch must not cause an "invalid" touch to be signalled. That is, on the "break" after the "make," the white light must not be actuated. Further, the weapon that signals a "valid" touch must be rendered incapable of signalling an immediately subsequent "invalid" touch. Conversely, it must be capable of signalling an "invalid" and a "valid" touch, in that sequence. A timer, adjustable by a simple potentiometer within the limits of 1 to 2 seconds is also required. Having been actuated by the start of the first signal ("valid" or "invalid," either fencer) the timer must prevent both weapons from signalling any more touches made after the end of the pre-set time interval. There are a number of other stringent electrical requirements. We will refer to some of them as we describe a specific design developed and manufactured by the author for championship fencing. See Fig. 1 for the complete schematic diagram and parts list of the unit.

This apparatus gets all its power from a single 6-volt storage battery. The 3-wire cable from each fencer plugs into the apparatus. In both

is picked up by L_1 and ΔC_1, tuned to the proper frequency, and coupled

cables #1 wire is the mass of the weapon, #2 wire is the point, and #3 connects to the metallic jacket. Number 1 wire is *neutral* or *common* to both weapons. This is done so that should one fencer make a touch against the blade or knuckle guard of the other's weapon the circuit would still be closed electrically and no touch would be signalled.

The basic circuit for "invalid" signalling is shown in Fig. 3A. The contacts of the relay are closed when the weapon is connected to wires #1 and #2. Fig. 3B shows the detailed "invalid" signal circuit necessary to meet the electrical specification requiring the signal circuit to release when a resistance of more than 10 ohms appears at #1 and #2. Fig. 4A shows the basic "valid" circuit. Here the relay is normally not energized and the contacts are normally closed. When a voltage is applied to the metallic jacket (#3 wire) as happens when a point is depressed against it, the relay is instantly energized. The relay contacts then open and actuate the "valid" signal. In order to prevent the "invalid" circuit from registering a "touch" on the "break" after the "make," a dual-coil relay is used in the circuit shown in Fig. 3B. One of these dual-coils is connected in series with the "valid" relay, as shown in Fig. 4B.

The timer relay is a sensitive double-pole, double-throw unit shunted by a potentiometer and a fixed resistor. Across this circuit is a large capacitor. Voltage is normally applied to this circuit, energizing the relay and charging the capacitor. When any touch is signalled, the voltage source to the timer relay is removed instantly. The capacitor discharges through the relay at a time interval determined by the setting of the potentiometer. When the relay's armature is finally released, both weapons are shorted and touches that have been signalled to that moment are locked "on." No more signals can be actuated until the circuits are deliberately reset. A 6-pole single-throw relay is used for the "reset." The buzzer is the "director's" signal to "halt" the fencers at that instant. The buzzer starts simultaneously with any of the optic signals and stops automatically at the end of the timer's action.

A note of caution to designers. Fencers become thoroughly wet and saline. Even their leather gauntlets and the padding of their masks become sopping and salty. Being emotionally "keyed up" during a bout, they become quite sensitive to electric shock. Shocks can be caused by kickbacks (inductive) from relays and by excessive potentials (with inadequate current limiting) at the weapon points. These effects can be, must be, minimized. After you've built your apparatus, soak yourself with heavily salted water, pick up a connected weapon with your bare hand and try it on yourself. But, be sure you know what you are doing, otherwise you are in for a shock. -30-

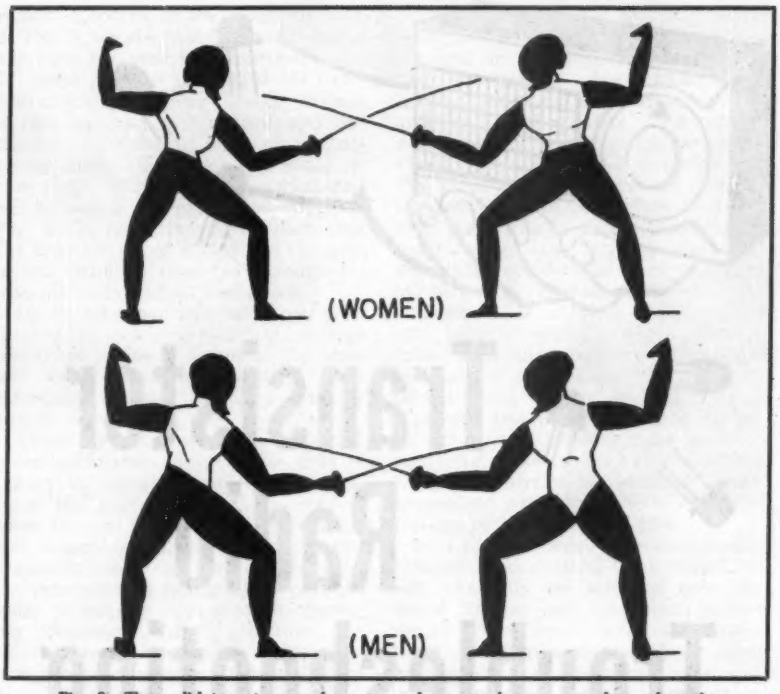


Fig. 2. The valid target areas for men and women fencers are shown here in white, while the invalid target areas are shown in black. In actual practice the fencing uniforms that are employed during a match are all white in color.

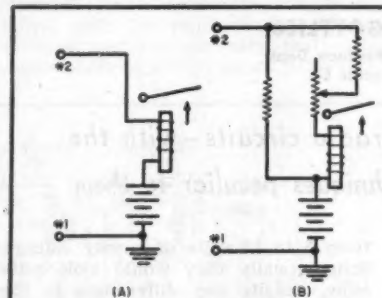


Fig. 3. (A) shows the basic "invalid" circuit. (B) shows the modified circuit that is employed in its final form.

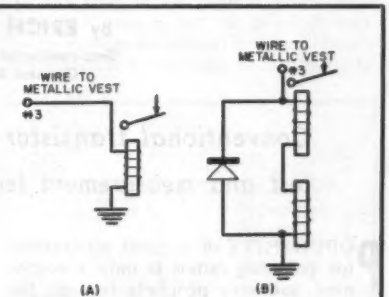
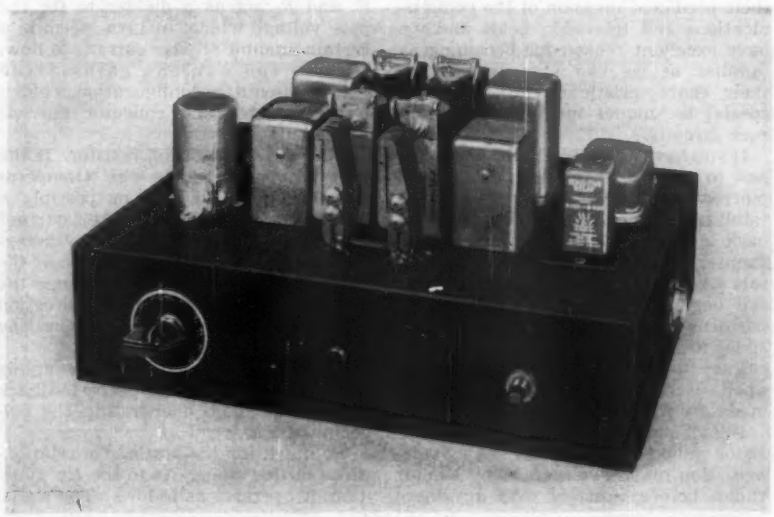


Fig. 4. (A) The basic "valid" circuit. (B) Final "valid" circuit uses a crystal diode to suppress inductive kickback.

Top view is shown here with the cover removed. Most of the relays are visible.



has a lower turns ratio than the 1st.

Use is next made of a crystal diode

radio." Looking at the block diagram of Fig. 3, we see that the audio driver

To analyze the a.c. system briefly, since the latter will generally be the

Transistor Radio Troubleshooting

By **ERICH GOTTLIEB**
Semiconductor Products Dept.
General Electric Co.

Conventional transistor radio circuits—with the test and measurement techniques peculiar to them.

POPULARITY of current all-transistor portable radios is only a beginning, industry prophets tell us; for all, not just some of tomorrow's portables, will be fully transistorized. In addition, transistors have already made their bow in phonographs, car radios, and radios for the home. Add to this their predicted invasion of the communications and television fields and we have excellent reason for becoming as familiar as we can with transistors, their characteristic circuits, and the special techniques for troubleshooting such circuits.

If you have not been called upon until now to service a transistor portable, tomorrow may be the day. It would certainly pay to get acquainted with the basic circuits one may expect to encounter in the various transistorized sets now available. Already these sets are beginning to conform to certain patterns to the extent that it is possible to generalize basic circuits, rather than to be reduced to looking upon each new receiver as a thing apart from its fellows.

Fig. 1 shows a conventional 6-transistor radio having a 9-volt supply voltage. You may have seen many similar radios before, possibly with anywhere from 3 to 12 volts of supply voltage. Schematically they would look quite alike, despite any differences in the supply voltage.

The first circuit of interest would be the single-stage converter. Here, R_1, R_2, and R_3 are used to obtain and maintain a stable d.c. operating point. R_1 and R_2 act as a divider to fix the base voltage which, in turn, permits a certain amount of base current to flow. Due to the current gain in the grounded-emitter configuration, a much larger emitter and collector current will result.

R_3 is the stabilization resistor. If the base current tends to rise (temperature rise may do this, or possibly a different grounded-emitter current amplification factor obtained by changing the transistor, for instance) the voltage drop across R_3 will change the base-to-emitter voltage in the direction of a reduced bias, thus compensating for the initial charge.

R_4 and C_3 form a simple decoupling network designed to prevent feedback of i.f. and audio energy into the collector of TR_1.

So much for the static, d.c. relationships in this stage. As to the a.c. function, it operates as follows: The signal is picked up by L_1 and ΔC_1, tuned to the proper frequency, and coupled through C_1 to the base of TR_1 (grounded-emitter mixer). Energy is fed back from the collector through L_2 to the tank circuit of L_3 and ΔC_2, tuned to the oscillator frequency (455 kc. above the incoming signal frequency). A portion of the oscillator voltage is then fed back into the emitter of TR_1 through the coupling capacitor C_2. Thus, the oscillator operates in the grounded-base configuration. The result of the mixing of the r.f. and oscillator signals is the difference of the two, or 455 kc. to which the i.f. transformer is tuned. The reason for the taps on L_1, L_2, and the i.f. transformer is to create an impedance match between these high-impedance networks and the low impedances they are working into, thus maintaining a satisfactory operating "*Q*".

The next stage is the 1st i.f. stage. Both input and output are transformer-coupled, matched as to resistance and reactance, and tuned to 455 kc. From a d.c. standpoint, the stage is somewhat similar to the previous one with the difference that automatic volume control is added. Notice that here an audio voltage, proportional to the input signal, is taken off at the detector, rectified, and filtered by C_9, R_{11}, and C_5. It is then applied at the base of TR_2. This voltage becomes more negative as the signal increases, thus reducing the collector current of TR_2. This, in turn, will reduce the power gain of the stage.

In this receiver, it was considered desirable to obtain a superior a.v.c. curve, as well as good overload characteristics. Thus the following auxiliary a.v.c. circuit was added: diode CR_1 was connected virtually across the load impedance of the converter circuit. However, instead of having one side of this diode go directly to "B+", it is connected to the top of R_7 as shown in Fig. 1, or that side of R_7 that is away from "B+". When there is little or no signal coming in, voltage division is such that CR_1 is biased not to conduct, or back-biased. In this condition, the diode constitutes a high impedance and thus has little effect on the circuit which it shunts. However, if signal input increases, output from the detector will also increase. Due to the primary a.v.c. action described in the preceding paragraph, this will result in a decrease of collector current in TR_2. This, in turn, will decrease the voltage drop across R_7, in series with the collector.

With reduced current, the top of R_7 thus rises toward "B+". This increase is sensed by CR_1, also connected to the top of R_7, and the diode is said to be forward-biased. In this condition it becomes a shunt of relatively low impedance and thus reduces gain in the converter stage.

The 2nd i.f. stage is quite conventional and very similar to the 1st stage with these differences: a.v.c. is absent and a somewhat lower impedance i.f. load is used—the 3rd i.f. transformer

The first check is to determine

can be eliminated as the area in which

the two, the emitter will be slightly

has a lower turns ratio than the 1st.

Use is next made of a crystal diode detector slightly forward-biased at zero signal by R_{12}, R_{11}, and R_8. After detection, the signal is *RC*-coupled to a class A audio driver stage operating at about 1 ma. of collector current. This stage is then transformer-coupled to the class B push-pull output stage. The latter is biased at a very low forward current by R_{17}, R_{18}, and R_{19} to minimize distortion. A radio of the type just described will be capable of delivering up to 750 mw. of power output at the present time.

The next illustration, Fig. 2, shows part of a receiver using the same type of converter, 1st i.f., 2nd i.f., detector, a.v.c., and auxiliary a.v.c. as the six-transistor radio of Fig. 1. The major difference here is the single-ended class A output stage delivering about 50-70 mw. maximum power output to the speaker. Such a radio will generally be a miniature type of portable.

After detection and audio small-signal amplification by the *RC*-coupled driver stage, the signal is fed through C_{10} to the base of TR_5. The output stage is biased at a collector current of about 14 ma. and a collector-to-emitter voltage of about 7.5 volts. Having a dissipation of 105 mw., this stage will thus be capable of delivering a power output of about 50 mw. at 10% distortion.

The next receiver, a somewhat newer member of our family of transistorized units, is the so-called "reflex radio." Looking at the block diagram of Fig. 3, we see that the audio driver has been replaced by making the 2nd i.f. stage perform the additional function of audio amplifier through the use of split input and output loads and "reflexing" or bringing back of the detected audio signal into the input of this stage. How this is accomplished can be seen in the partial schematic of Fig. 4. C_{10} feeds the signal back into the base circuit of 2N169 and the amplified signal is then fed through C_{13} into the audio-output stage base.

Up to here, our discussion has been limited to the operation of various transistor radios as found on the market today. Now let us divide this seemingly complex circuitry into its simple components.

There are two major systems in any given transistor circuit. The first is the a.c. or signal system which constitutes the part of prime importance, since the job in a radio is to pick up and select an r.f. signal within the broadcast range and then convert it to an intermediate-frequency signal in order to amplify it at a lower operating frequency. After detection, the resulting audio intelligence is then amplified to the point of being able to drive a speaker.

The second is the d.c. system, which acts as a tool to provide the active elements (here transistors instead of tubes) with the required d.c. supply voltages and bias currents, that will enable them to act on signal properly.

To analyze the a.c. system briefly, since the latter will generally be the simplest in terms of servicing, it is mainly composed of antennas, oscillator coils, i.f. and audio transformers, and finally the speaker. If a trouble exists in this chain, it will generally be a short-circuited or open-circuited coil. The areas of higher incidence of service problems can be spotted in a d.c. test. As a rule of thumb—and this is contrary to the long-accepted rule with tube receivers—a transistor, having no heater or appreciable power requirements, is a much more rugged and reliable active element than a tube. It should therefore be the *last* and not the *first* component to be suspected when trouble occurs. This is especially true in personal portable receivers using subminiature components, *i.e.*, coils using extremely fine wire, electrolytics of extremely small dimension with somewhat marginal voltage ratings, and the like.

In a printed-circuit transistor radio, transistors, because of their reliability, will generally be soldered into the board. Testing each transistor, as one would tubes, would not only subject the transistors unnecessarily to high peak heating by soldering irons, but would probably damage some other components and principally the printed circuit board.

Now that some ground rules have been laid down, let us proceed logically, taking an actual case: A faulty transistorized receiver is brought in.

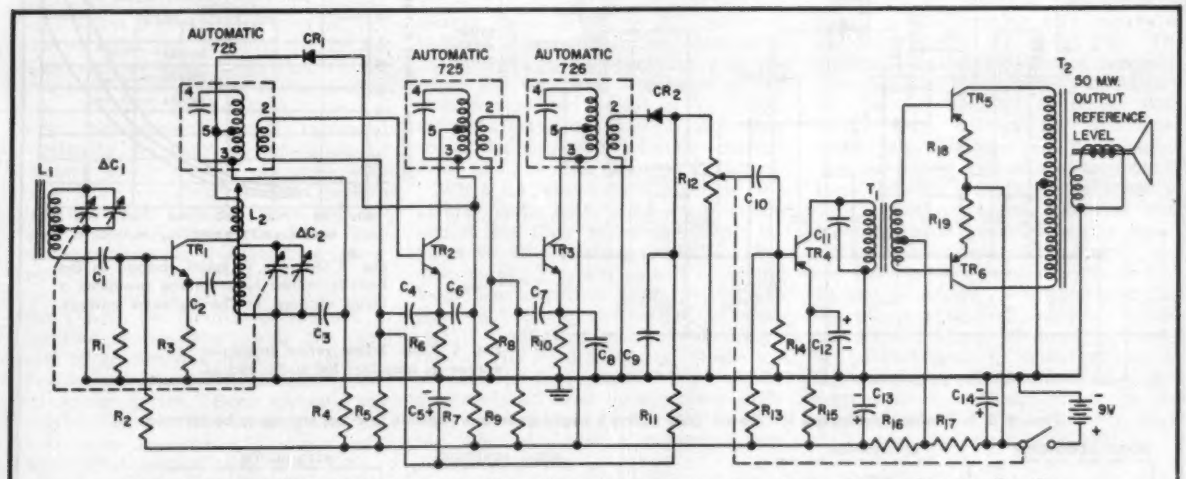


Fig. 1. Schematic of a typical 6-transistor radio, with an autodyne converter, two i.f. stages, and push-pull audio.

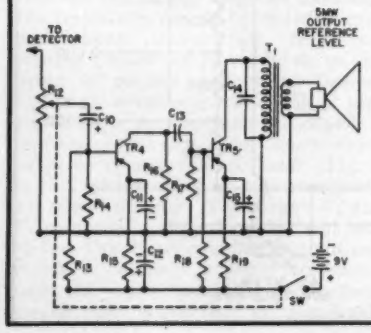


Fig. 2 (Left). Audio circuit of 5-transistor set with single-ended output.

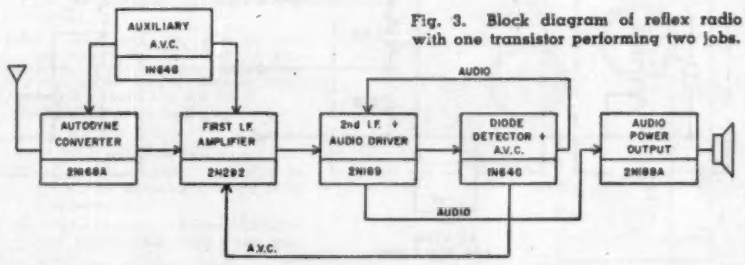


Fig. 3. Block diagram of reflex radio with one transistor performing two jobs.

A SMALL lamp connected to a loop of wire constitutes a simple, yet

Sensitive

The first check is to determine whether the battery voltage *under load* is high enough to operate the receiver. Although most receivers are designed to operate down to one-half the battery voltage, severe distortion, low sensitivity, and reduced power output result from a low supply. After a quick visual inspection to determine whether loose or torn battery, speaker, or antenna wires are present, the set can be analyzed further.

The quickest method is signal injection: signal is brought into each stage starting with the speaker and working back to the antenna, if necessary. In its general form, this procedure is not very different from that used in radios with tubes, with a.f., i.f., and r.f. signals being obtained from appropriate generators and note taken of output from the receiver. In dealing with transistor stages like those shown here and commonly used in radio circuits, signals are injected at the base.

In the audio stages, at first—the volume control is a good point to start, for instance—an audio rate signal is applied at the appropriate level. Establishment of this level will be discussed later. Either the oscilloscope or direct listening can be used to determine whether a clean sine wave of adequate power output appears at the speaker. If it does, the audio circuits can be eliminated as the area in which the trouble lies.

Next, an r.f.-i.f. generator should be used to determine, stage-by-stage (going from base-to-base up to the antenna), the operating condition in this section using an i.f. signal modulated at 30% with either a 400- or 1000-cps audio sine wave. Most r.f. generators provide such modulation. Note: Care must be taken that the generator's leads have a d.c. blocking capacitor in series in order not to change the bias condition in the circuit under investigation.

As soon as the applied signal fails to go through a stage of amplification, this stage's d.c. system should be investigated. As a first check, it should be determined that both supply voltage magnitude and polarity are appropriately applied.

Where *p-n-p* transistors are used, the emitter will be the most positive element, as far as d.c. is concerned. The base will be almost at the same voltage, but slightly less than the emitter. The collector will be substantially negative with respect to either of the other two electrodes. Where *n-p-n* transistors are used, the situation is reversed, that is, the collector will have the most positive voltage applied to it, with both base and emitter being considerably more negative and fairly close to each other. However, of the two, the emitter will be slightly more negative.

Note that the voltages on the various electrodes are cited only in relation to each other, rather than to some such arbitrary point as ground. This is done because the ground point may vary considerably from one receiver to another, depending on whether transistors used are of the *n-p-n* or *p-n-p* type or whether the circuit uses both types. Sometimes, unlike the practice with vacuum-tube receivers, the positive end of the battery will be grounded and the negative terminal will be below ground. Although ground may be the reference point for all readings when a schematic is available, it is well to remember the relationship of the electrodes to each other.

Fig. 5 shows collector current (I_c) *versus* base-to-emitter bias voltage (V_{BE}). Notice that a very small increase in V_{BE} produces a large increase in collector current. Thus, you will generally find .1 to .2 volt between base and emitter, corresponding to the statement that base and emitter are almost at the same voltage.

The next step would be to determine bias current. Since base, emitter, and collector currents are dependent on one another, it generally suffices to measure only one, the collector current for instance. This latter should be al-

(*Continued on page* 150)

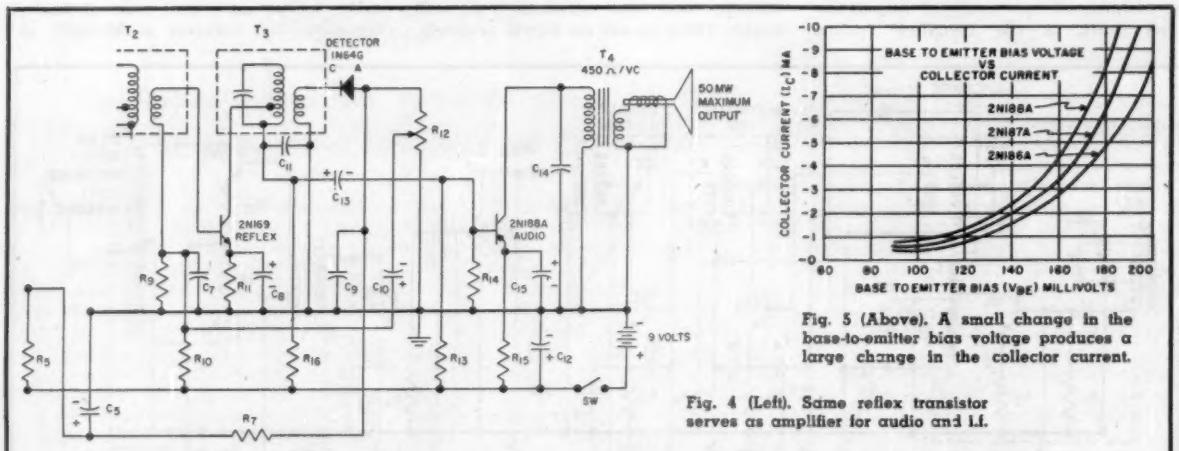


Fig. 4 (Left). Same reflex transistor serves as amplifier for audio and i.f.

Fig. 5 (Above). A small change in the base-to-emitter bias voltage produces a large change in the collector current.

Figs. 6 & 7. Simple attenuators for the r.f. (left) and a.f. (right) generators enable low test signals to be metered.

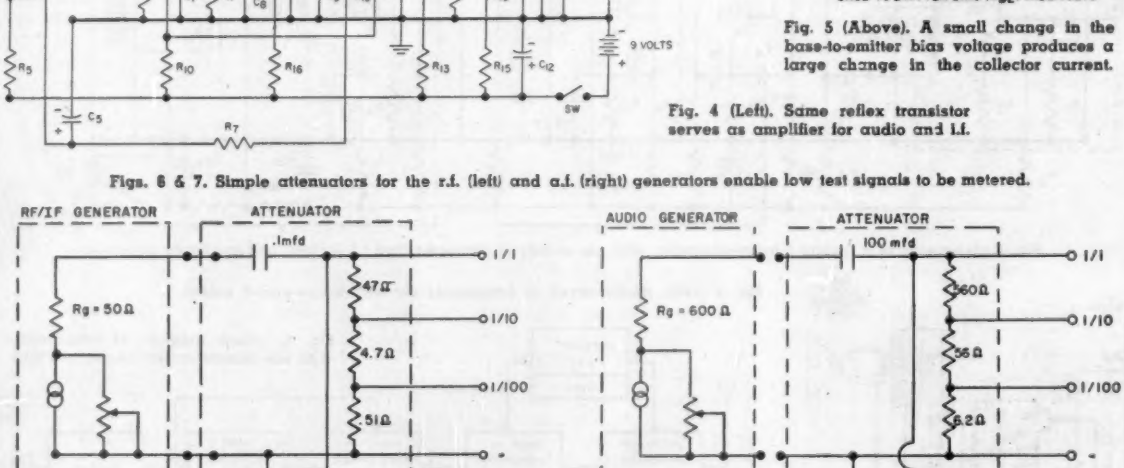
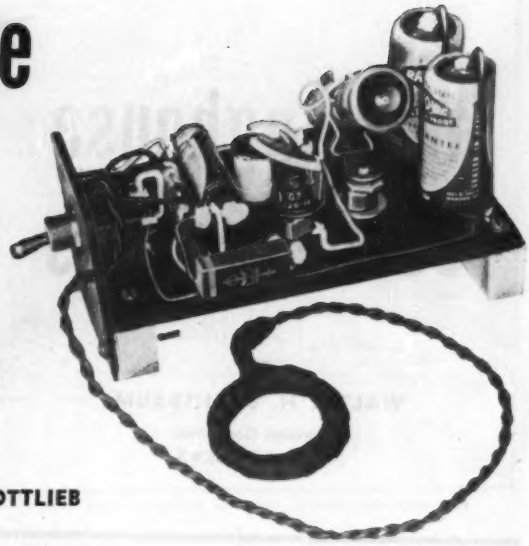


Fig. 1. Use of a rec-

Sensitive R. F. Power Monitor



By **IRVING M. GOTTLIEB**
W6HDM

Transistors are used to boost the sensitivity of this "loop and lamp" r.f. indicator for the ham.

A SMALL lamp connected to a loop of wire constitutes a simple, yet useful, monitoring device for evaluating the relative level of radio-frequency power developed in a tank circuit. Although the years have brought breath-taking progress in instrumentation, this primitive device remains a highly esteemed tool by technicians, amateurs, and experimenters.

In typical use, the loop is loosely coupled to a tank circuit. Radio-frequency power is transferred from the tank coil to the loop by electromagnetic induction and the lamp is energized. The light intensity produced by the lamp is readily correlated with operating conditions and alignment procedures. Small changes in power level are detected by the eye because both light intensity and color change with power. Employed in this manner, the "loop and lamp" often permits closer adjustment to optimum radio-frequency operating conditions than might be attained by use of grid- and plate-current meters. In any event, the r.f. energized glowing lamp provides additional valuable information.

There are, however, instances wherein the sensitivity of the simple loop and lamp is not adequate. Anyone who has experimented with transistor r.f. oscillators can appreciate this because the power developed is generally too low to light even a very small lamp. The tuning of transceivers is rendered difficult because of the low power and high frequency. An annoying amount of see-sawing, fudging, and interpolating can be involved in the alignment of these units due to the frequency pulling effect of the pickup loop. What is needed here is an r.f. power indicator with greatly increased sensitivity so that an indication of relative power can be obtained with very loose coupling between pickup loop and tank circuit. Other applications suggest themselves when one contemplates uses of a sensitive power monitoring device. Neutralization and the detection of parasitic oscillations would both be facilitated by such a sensitive device. Monitoring the current in an antenna transmission line requires minimum disturbance by the indicating device. But, enough has been said on behalf of possible applications of a sensitive r.f. power indicator; what can be done about it?

By inserting a transistor amplifier between the pickup loop and the lamp, the sensitivity can be extended to produce lamp illumination from r.f. sources generating power levels on the order of several milliwatts. *Despite this high sensitivity, the lamp is protected from burnout and the device is immune to injury from short exposures to very great overloads.* Fig. 1 is the schematic of a high-sensitivity r.f. power monitor. Transistors V_1 and V_2 comprise a direct-coupled d.c. amplifier. The direct coupling is a natural result of driving a *p-n-p* transistor from an *n-p-n* transistor when both stages are connected as grounded-emitter amplifiers. This combination yields the desirable parameters of high imput impedance and high power gain. Diode CR_1 is polarized to transfer the operation of transistor V_1 from cut-off to collector current conduction when r.f. power is induced in the pickup loop. When no r.f. power is induced in the pickup loop, transistor V_2 is deprived of operating bias because the very high resistance of the collector-emitter circuit of V_1 blocks current flow from battery B_1. Consequently, negligible collector current flows in V_2 and the lamp is not lighted.

When r.f. power is induced in the pickup loop, both stages are transferred into their collector current regions to an extent governed by the amount of r.f. power picked up in the loop. The transition of the two stages from cut-off to conduction is sufficiently gradual to permit stable operation at any light intensity. Operation at amateur frequencies would not be materially affected by removing diode CR_1 and filter capacitor C_1 because the input diode of a transistor will perform rectification at frequencies far beyond that where transistor action is no longer good. However, the diode and capacitor protect V_1 from the localized heating effect of radio-frequency current.

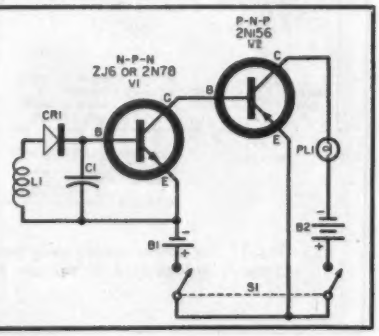
The author found it convenient to use a penlite housing as a means of mounting the 60 ma. lamp, PL_1. The original lamp and cell were removed. The cell was then utilized as battery B_1. Do not attempt to power both stages from battery B_2. Operation under this condition will be unstable because one of the cells of battery B_2 then becomes a mutual impedance to both amplifier stages. No heat sink is required for power transistor V_2.

The specifications of the pickup loop are intended for general work at 160, 80, and 40 meters. It is suggested that the constructor first establish operation with this loop. Thereafter, it may be advantageous to tailor a loop to the frequency range and tank coil geometry of the equipment to be aligned. Due to the relatively high

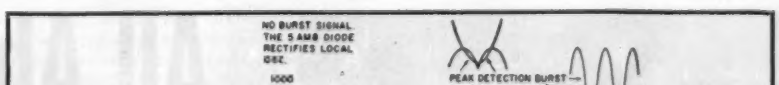
(*Continued on page 176*)

Fig. 1. Complete schematic and parts list for the r.f. power level monitor.

C_1—1 μfd., 200 v. paper capacitor
S_1—D.p.s.t. toggle switch
PL_1—S48 pink-bead pilot lamp, 2 v. @ 60 ma.
L_1—Pickup loop, 10t. #24 en. wire closewound on 1¼" plastic or fiber form. Make twisted wire connecting cord from flexible hook-up wire, length between 1½ and 3 feet
B_1—1.5 volt penlite cell
B_2—2 size 1LP cells
CR_1—1N56 germanium diode
V_1—"n-p-n" transistor (G-E ZJ6 or 2N78, beta within range of 20 to 40 is recommended)
V_2—"p-n-p" power transistor (CBS-Hytron 2N156 with highest beta possible)



Westinghouse models. Probably the outstanding feature is the small number of tubes employed. Only 24 tubes are used, exclusive of the tuner and



Westinghouse Color Circuits

By
WALTER H. BUCHSBAUM
Television Consultant
RADIO & TV NEWS

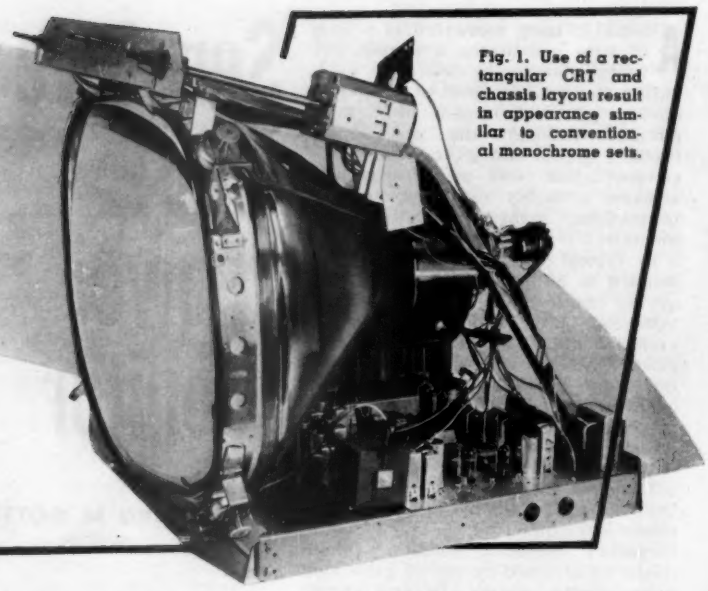


Fig. 1. Use of a rectangular CRT and chassis layout result in appearance similar to conventional monochrome sets.

The line is distinguished by use of an all-glass rectangular picture tube, printed wiring, a novel color-phase detector, and series-filament wiring.

UNDOUBTEDLY the most unique feature of the *Westinghouse* line of color TV receivers is the use of a 22-inch rectangular, glass-envelope, picture tube. This is quite a change from the 21AXP22 round metal-envelope picture tubes found in almost all other color sets. The use of an all-glass, rectangular tube makes the appearance of the *Westinghouse* color chassis sufficiently similar to a monochrome receiver to give the service technician a feeling of comfortable familiarity, which is desirable. The appearance of the chassis with the picture tube and front-control bracket is shown in Fig. 1.

Accessible operating controls include the on-off push-button and other conventional monochrome adjustments. Contrast, volume, and tone controls are on a concentric, triple-shaft unit. Chroma gain and hue are the only accessible color controls. Other color controls are under a removable panel at the left front side of the cabinet (Fig. 5). Subcarrier bandpass, i.f., color sync, and other adjustments can be reached without removing the chassis from the cabinet.

The chassis is used in four table models ranging from $495 to $545. Two finishes, mahogany and blonde, and the option of a u.h.f. tuner with each, account for differences among Models 22T155, -T156, -TU155, and -TU156.

To facilitate servicing and installation adjustments, the top as well as the back of the cabinet can be removed. To set the field equalizing magnets (located around the face of the picture tube) and to clean the faceplate, the safety glass and mask can be removed.

The set itself consists of six subassemblies, many of them composed entirely of printed circuitry. The tuner is either a v.h.f. or combination type, and a remote-control attachment is available for it. The power supply and i.f. section form one sub-assembly while the entire chroma section occupies one printed-circuit board, as shown in Fig. 6. All sync and deflection circuits are contained on another printed-circuit assembly, and the flyback section and audio output portions are on a subchassis of conventional design. Convergence, purity, and monochrome balance controls are located on a single panel, which is mounted on the lower left side as shown in Fig. 5.

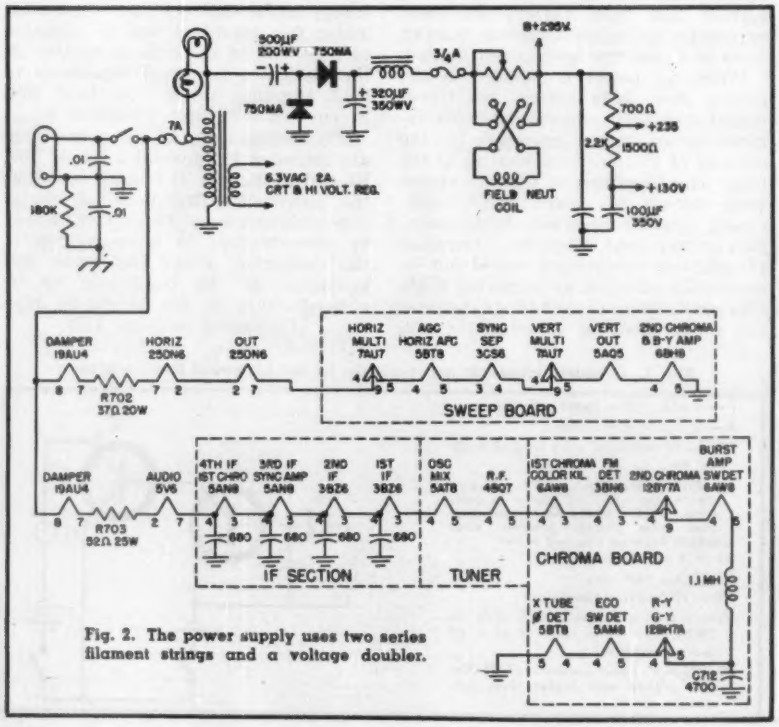


Fig. 2. The power supply uses two series filament strings and a voltage doubler.

Circuit Features

Before discussing individual circuit features, the tube layout and signal paths of Fig. 4 will be helpful in appreciating the innovations of the

All About Audio

Westinghouse models. Probably the outstanding feature is the small number of tubes employed. Only 24 tubes are used, exclusive of the tuner and the picture tube, despite the fact that the horizontal-output and the damper functions are each handled by two tubes connected in parallel. The use of so many multiple tubes in single envelopes accounts for the small tube number, since otherwise the circuit contains no electronic short-cuts that might affect performance.

For example, the *Westinghouse* sets use a full four-stage i.f. section, two stages of brightness-signal amplification, and two stages as chroma amplifiers. One of the reasons for the limited number of tubes is the new 5BT8 which contains a pentode and two diodes in a single, nine-pin envelope. Two of these tubes are used for four functions: color-sync phase detector, horizontal-oscillator phase detector, keyed a.g.c., and 3.58-mc. reactance tube.

The new *Westinghouse* color TV receivers are also somewhat unusual because they use series-filament tubes arranged into two strings connected across the 117-volt a.c. line. The circuit of Fig. 2 shows this arrangement, but also indicates that, for the picture tube and the h.v. regulator tube, a separate 6.3-volt transformer winding is used. The autotransformer steps the line voltage up by only 12 volts, which lights up the pilot lights as shown in Fig. 2. As B+ supply, two selenium rectifiers arranged in a voltage doubler provide 295 volts, which is then applied through a system of bleeder resistors to furnish the 235 and 130 volt busses respectively.

In some earlier models, the field neutralizing circuit shown in Fig. 2 is used; in later models, a PM type neutralizing assembly eliminates the need for this circuit. Note that there are two separate fuses in the power supply. However, if there is a filament short, no protection is provided except for the two surge-limiting resistors in the filament series strings.

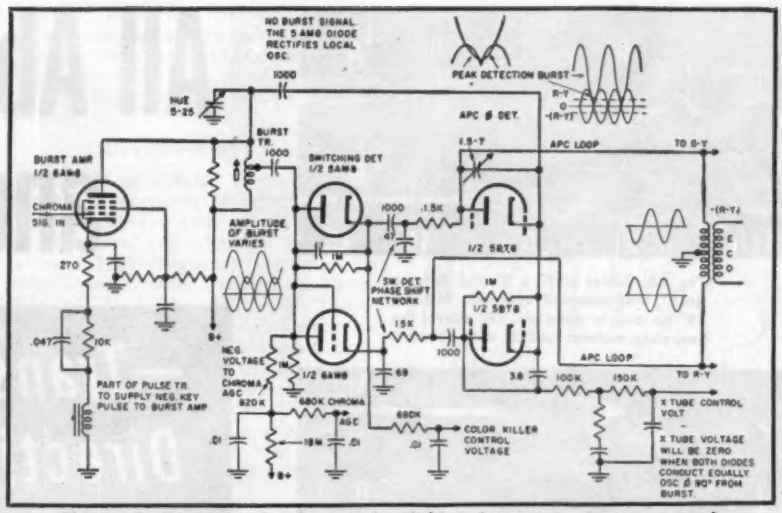

NO BURST SIGNAL THE 5 AMP DIODE RECTIFIES LOCAL OSC.
PEAK DETECTION BURST
APC Ø DET.
APC LOOP
TO G-Y
BURST AMP 1/2 6AW8
CHROMA SIG. IN
BURST TR.
SWITCHING DET 1/2 6AW8
AMPLITUDE OF BURST VARIES
1/2 5BT8
SW. DET. PHASE SHIFT NETWORK
NEG. VOLTAGE TO CHROMA AGC
1/2 6AW8
680K CHROMA AGC
PART OF PULSE TR. TO SUPPLY NEG. KEY PULSE TO BURST AMP
COLOR KILLER CONTROL VOLTAGE
APC LOOP
TO R-Y
X TUBE CONTROL VOLT
X TUBE VOLTAGE WILL BE ZERO WHEN BOTH DIODES CONDUCT EQUALLY OSC. Ø 90° FROM BURST.

Fig. 3. Combination color-phase and switching detector circuits are unusual.

One of the more unusual circuits of these receivers is the combination color-phase and switching detectors, which is shown in simplified form in Fig. 3. The burst amplifier is close to cut off due to the large cathode bias. This bias is overcome by a negative pulse from the flyback transformer during the horizontal flyback period, allowing only the color burst to be amplified. The two diodes of the 5BT8 are used as a conventional phase detector, in that both plates receive opposite-polarity signals from the local 3.58-mc. oscillator while their cathodes receive the transmitted color-sync burst. Error voltages are then filtered and supplied to the reactance-tube control circuit in the conventional manner.

The switching detector also consists of two diodes, since the grid of the 6AW8 triode section is connected to the plate. Detection takes place in the same manner as in the phase detector, except that the phase of the 3.58-mc. locally generated signal is shifted by 90 degrees. As a result, during color-sync burst reception, maximum d.c. potential is developed at the two diode plates. This negative voltage depends on the sync burst amplitude, and can therefore be used as a.g.c. bias to control the first chroma amplifier. By re-

(*Continued on page* 126)

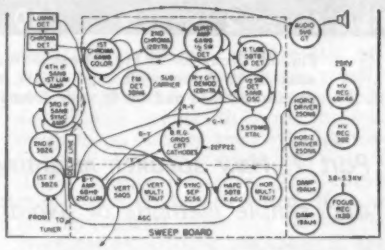


Fig. 4. Signal path and 24-tube layout. Multiple tubes prevent design skimping.

Fig. 5. Service-adjustment panel is at front of left chassis side.

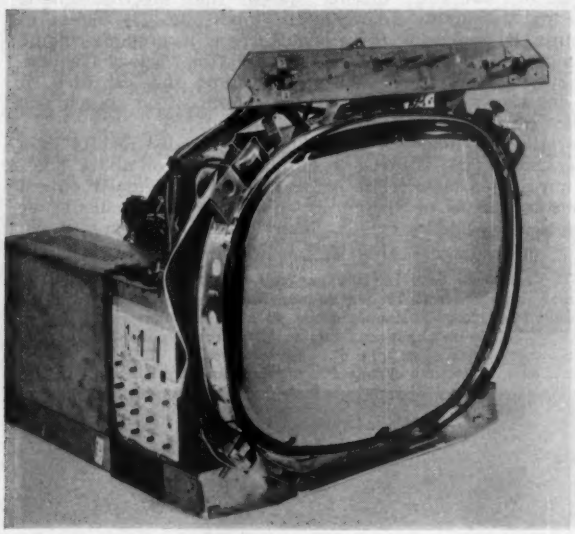
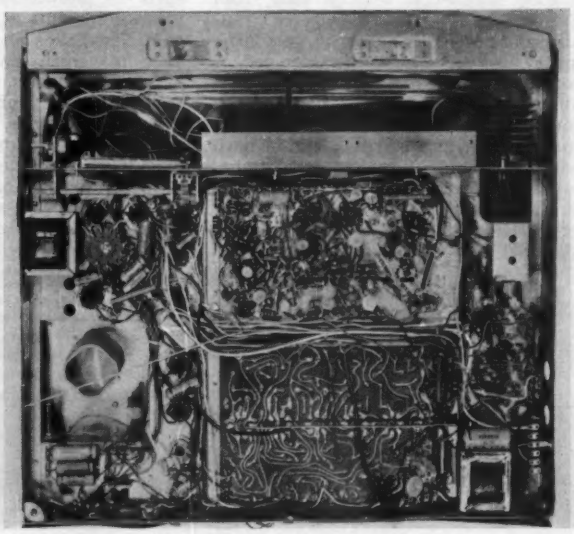


Fig. 6. Under-chassis view: chroma section is on printed board.



upper register, and therefore require a speaker unit with strong output in the treble for a reasonably balanced performance. A "perfect" speaker unit

is much finer and harder and this device also has a very quick restoring action on cone movement which cleans up the transient nature of the repro-

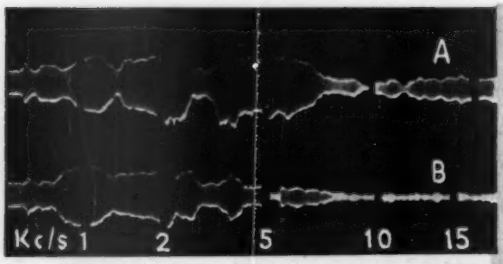


Fig. 29. Effect of 7" x 1" slot diffuser on 8" wall-mounted speaker. Mike is 18" on axis in open air. (A) shows the response without and (B) with diffuser.

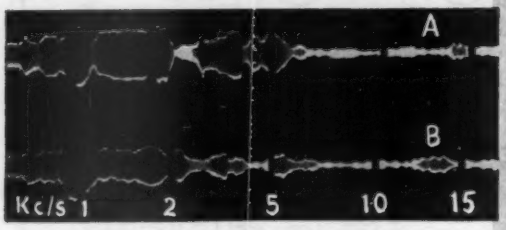


Fig. 30. Same as for Fig. 29 except that mike is 30 degrees off axis. (A) is response without and (B) is with diffuser.

All About Audio and Hi-Fi

—Transients and Directional Effects

By G. A. BRIGGS
Managing Director
Wharfedale Wireless Works Ltd.

Part 7. How speaker mounting affects transient response and simple methods of avoiding high-frequency beaming.

AT THE end of the previous article the effect of shock treatment on various speaker units was illustrated, but as a high-impedance source of about 56 ohms was used, the results showed more "ringing" than would occur under normal conditions of use where the high damping factor of the amplifier plays a not insignificant part.

The following tests show the effect of different methods of mounting a 10" speaker, 10-15 ohm type, with the source impedance reduced to 15 ohms to give a damping factor of about one-to-one. With open baffle mounting and a good magnet it will be seen from Fig. 31A that ringing has been virtually eliminated, in spite of the large initial displacement of the voice coil. A comparison of this curve with the others (B, C, D, and E) confirm the contention that you cannot put a speaker unit in a cabinet or on a horn without making it sound like it, because it affects the natural movement of the cone.

The cleanest results are obviously obtained from the open baffle, but nature is again perverse and limits our bass output by the size of the baffle. If we counteract this by increasing the bass input by 6 db per octave we tend to overload the unit, hence the development of so many resonant enclosures and folded horns. But a couple of speakers in parallel on a baffle give a 3 db gain at low frequencies, and double the power handling capacity, and various methods of damping to avoid excessive cone movement and distortion, without boxing in, are possible.

It would be difficult to give a complete technical explanation of the results as shown in Fig. 31, but the following points strike me as significant. The reflex enclosure (B) reduces cone movement but increases power handling capacity. The corner model (C) weighs 44 pounds and shows signs of panel resonance, which can be heard in the program material. The huge and heavy exponential horn (D) is probably better than any folded horn but, surprisingly, still shows signs of metal ringing which is faintly audible on program.

The brick enclosure (E) shows a clean line and lowest resonance of the lot but is followed by slight traces of enclosure resonance, again faintly audible on program.

The circuit used for the tests is given in Fig. 32. A scope with a driven sweep is used. R_1 gives control of the input voltage (E_1) and R_2 enables the d.c. voltage across the oscilloscope terminals to be balanced out and so avoid the false transient due to the a.c. coupling of the scope input circuit.

Cone Breakup: Poor transient response is not entirely due to insufficient voice-coil damping. We are still left with the serious problem of low damped resonances in the cone itself and in the enclosure (if one is used) which are so loosely coupled to the driving system that electromagnetic damping is impossible. The effect of these resonances is to produce ringing and hangover at the various frequencies concerned and this, in turn, is manifest as coloration on speech and music.

Cone breakup usually results in a rise in output in a region above 1 kc., but before this is condemned out of hand a word of warning should be given. Many reflex enclosures boost the bass by resonance, but mask the

Fig. 31. Shock tests showing effect of speaker mounting. A 10" foam-surround, 14,000-gauss unit was used. Source impedance was 15 ohms and input was 4 volts. (A) Speaker mounted in plane baffle 2½ feet square. Note clean movement with abrupt finish. (B) Speaker in 2 cu. ft. reflex cabinet. Cone movement reduced, ringing drops off at exponential rate. (C) Corner horn-loaded reflex cabinet made of ⅝" plywood. Uneven kink with continuous ringing. (D) Large exponential horn, 5½ feet long, 4 foot mouth, weighing 175 lbs. Note ringing from metal horn in spite of heavy construction. (E) Brick 9 cubic foot corner enclosure employed for the speaker. There was a large movement of cone with low resonance frequency.

Practical Color TV

upper register, and therefore require a speaker unit with strong output in the treble for a reasonably balanced performance. A "perfect" speaker unit with flat response would sound awful used alone in such a cabinet.

Various techniques have been devised for studying transient decay behavior using chopped tone and pulse excitation, but none of these methods has proved completely successful. The best tests to date are probably subjective ones employing white noise and male speech, as the coloration imparted to these sounds is quite distinctive on the *A-B* test. With experience, it is possible to locate roughly the trouble region by listening carefully to white noise. Panel resonance can be exposed by banging a cabinet with a hammer or even the fist; the general pitch of the sound so produced with flimsy enclosures is easily heard as coloration on white noise. Unfortunately white noise cannot be used as a complete guide until somebody produces the perfect speaker as a 100% reference point, so that we know exactly how white noise *ought* to sound.

It is of course elementary to say that nothing facilitates subjective tests as much as a point of reference. I never like to pass a final opinion on the performance of any speaker until I have had an opportunity of comparing it directly with the best available. In the same way, live *versus* recorded comparisons in a good concert hall are invaluable.

Panel vibrations in poorly constructed enclosures give much the same effect as cone breakup, although at lower frequencies around a few hundred cycles-per-second. Such resonances produce "chestiness" and are quickly exposed by tests with male speech. The only solution is rigid construction using heavy timber, sand-filled panels and/or, best of all, concrete or bricks.

General Definition: A transient is an energy pulse where the intensity changes over a wide range in a very short time. A hand-clap is an example of a sound with steep starting transients at high frequencies, but the termination is of equal transient significance. Wide frequency range and absence of hangover or ringing are clearly necessary for good transients of both varieties.

Centering Devices: Even the centering device has an effect on high-frequency performance and transient response. Corrugated discs are now used on the majority of loudspeakers because of speed of assembly, concentric reliability, and dustproofing of gap. But the open spider made of fine Bakelized fabric may give slightly better high-frequency performance and improved transient response. There are two main reasons. The disc is made with a neck about $\frac{1}{16}$" in depth which is necessary for glueing the device to the cone and coil assembly. This has a damping effect on the transmission of the highest frequencies from coil to cone. The edge of the Bakelite spider is much finer and harder and this device also has a very quick restoring action on cone movement which cleans up the transient nature of the reproduction to an audible degree on *A-B* testing.

Directional Effects

It would be difficult to over-emphasize the importance of directional effects in middle and upper registers when natural reproduction is the objective. High-frequency beaming is often objectionable. Even in the Royal Festival Hall the effect of tilting middle and treble units upwards or to an angle of 45° can be observed by a listener at the back of the stalls at a distance of more than 100 feet. In fact, I would go so far as to say that satisfactory reproduction in a concert hall is impossible if these directional effects are not carefully studied and controlled.

One of the simplest ways of spreading an objectionable beam and reducing peaks at 1-5 kc. resonance is to fit the well-known "*KB*" slot in front of the cone as illustrated at the left in Fig. 33.

The length of the slot should be the same as the piston diameter of the cone, the width being determined according to the frequency range involved; it is most effective when it is less than the wavelength. Thus 1" wide will answer for frequencies up to 13,500 cps. With a 5" speaker, a slot 3" long and ¾" wide is about right.

The device worked wonders in a schoolroom with large windows and hard walls, where the reproduction of speech is often incoherent.

The oscillograms of Figs. 29 and 30 show the effect—on and off axis—of placing the slot diffuser in front of an 8" unit which gives excellent results in a small Helmholtz resonator but needs some control in the 1 to 5 kc. region when mounted on an open baffle. For this test, the speaker was mounted in a wall facing outside—probably the best arrangement ever devised for speaker measurements. The microphone distance was 18"—rather close—but the object was to study the effect of the diffuser rather than to produce an accurate response curve.

It will be noted that the output on-axis with the diffuser is about the same as 30° off-axis without the diffuser. The use of the diffuser greatly reduces the difference between axis and off-axis results. In short, there is much to be said for the device at frequencies above 1000 cycles, but with a single speaker covering the entire range there is severe obstruction at low frequencies. This can be largely overcome by altering the shape of the slot and adding extra holes, as shown at the right in Fig. 33.

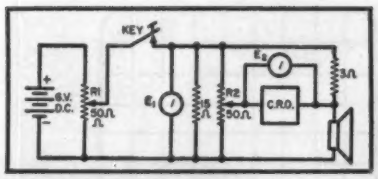


Fig. 32. Here is the circuit (after E. M. Price) used for transient tests.

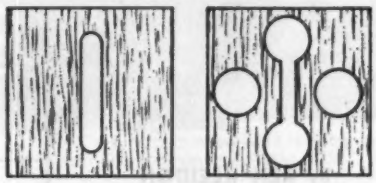


Fig. 33. Appearance of the Kolster-Brandes Ltd. slot diffuser is shown at the left. At the right is shown a modified diffuser designed for use with a single speaker. This diffuser avoids resonance and restriction of output at the lower audio frequencies. Quarter-inch or ⅜" plywood may be employed.

Suitable dimensions for general use are:

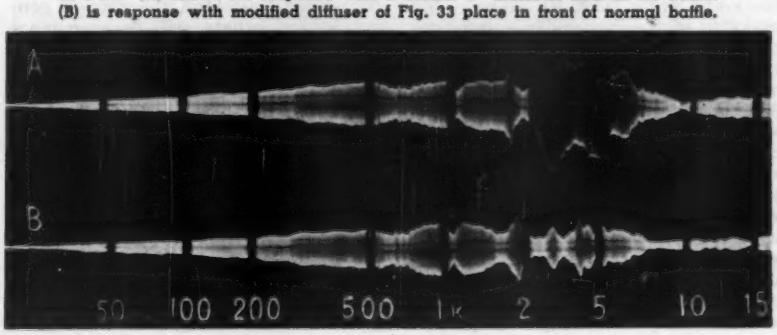
Speaker	5"	10"	12"
Width of slot	1"	1"	1"
Diameter of four circles	2"	2½"	3"
Length of straight portion of slot	3"	3½"	4"
Over-all length of main slot	7"	8½"	10"

A sample diffuser can easily be cut out of a piece of cardboard for test and placed in front of the loudspeaker. If the effect meets with approval, a permanent sub-baffle of plywood can be made at moderate cost.

In order to test the effect of the modified diffuser, discs of aluminum foil (*genus*—milk bottle tops) were glued to the surface of the cone of an 8" speaker, fitted with aluminum voice

(*Continued on page* 192)

Fig. 34. Oscillograms of response of 8" speaker with metal discs on cone. Curves taken in open air at an input of 1 watt. Mike is at 18" on axis. Speaker mounted in wall. (A) shows the response with a normal 7" diameter hole in the baffle. (B) is response with modified diffuser of Fig. 33 place in front of normal baffle.

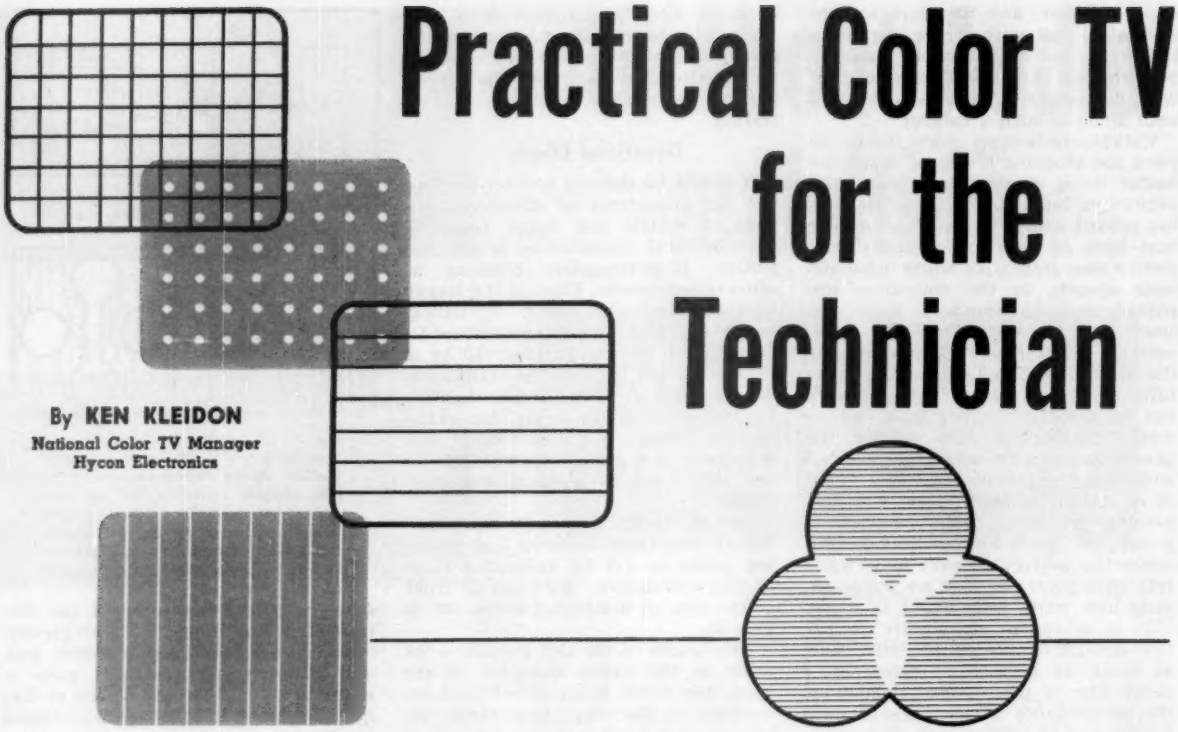


vertical scanning frequencies of the receiver must be the same during convergence adjustments as when a station's signal is received. If the gen-

representing the color burst is not at 3.58 mc. For these reasons, the signal produced by such a generator is of lit-

Practical Color TV for the Technician

By **KEN KLEIDON**
National Color TV Manager
Hycon Electronics



Part 5. The features of the specialized and the regular test equipment used in color TV service.

THE FINAL area with which the service technician must become familiar covers the techniques and procedures necessary for servicing, including the equipment involved.

Color TV test equipment has received considerable publicity in the form of magazine articles and general advertising, with many claims being made as to features, capabilities, and usefulness. Some of this information is confusing. The purpose of this article is to acquaint the technician with the basic requirements of the additional test instruments required for color servicing.

As noted in the introductory article of this series, one of the requirements of a color receiver is that it be capable of receiving a monochrome transmission and reproducing a picture in black-and-white. Correspondingly, the majority of the circuits in a color receiver will be found to be identical to the type of circuits employed in a monochrome receiver. Approximately 80% of the circuitry in the former is similar to those circuits found in a monochrome receiver. These can be serviced in the same way with the same test equipment. For this reason, when test equipment for color servicing is considered, the most important will be the test equipment presently used for servicing monochrome receivers. Thus, equipment for color service will fall into four categories: present monochrome test equipment; convergence generator; color-bar generator; and wide-band scope. The last, of course, may already be included under present equipment, but merits separate mention.

A convergence generator produces a suitable pattern on the face of the color picture tube for alignment of the convergence controls. Convergence adjustments align the electron beams of each of the three guns of the color picture tube so that they will be in proper register.

Concerning the first category, present equipment, note that every unit presently used for servicing conventional TV receivers will continue to be used and will not be obsolete—as long as it has not been made obsolete for monochrome work. In fact, the v.t.v.m., the sweep generator, the marker generator, and others, will be even more valuable because, in addition to the uses they will continue to serve in the monochrome portions of color receivers, they will be assigned added jobs.

Color TV manufacturers disagree as to the type of pattern best suited for the convergence adjustments. One manufacturer recommends a dot pattern, white on black, while another calls for a cross-hatch pattern consisting of white vertical and horizontal lines on a black background. Still another specifies a dot pattern for center d.c. convergence, horizontal lines to complete the dynamic adjustments, and then recommends a cross-hatch pattern for over-all touch-up adjustments. These variations are shown in Fig. 1. However, the trend seems to be toward recommending vertical and horizontal lines for dynamic convergence adjustments rather than a dot pattern.

One reason for this tendency is that color picture tubes in use do not display identically shaped red, blue, and green dots over their entire screen. One tube recently examined displayed dots similar to those illustrated in Fig. 2A. When the odd-shaped dots are overlapped (Fig. 2B), it is difficult to determine when correct convergence is obtained. When these irregular dots blend together in solid lines (Fig. 2C), it is easier to judge convergence. Another reason lines are preferred in place of dots is that the effects of control adjustments are more easily observed. A continuous line indicates bowing or bending more clearly than a series of dots. It also tends to reduce eye strain.

Manufacturers do, however, agree that the convergence generator must produce a signal which provides adequate brightness, remains stationary, and generates synchronizing signals that correspond to those of a transmitted station. Pattern stability for convergence work is, of course, an important consideration.

Of prime importance is that the convergence generator, whether the signal used is r.f. or video, must supply vertical and horizontal synchronization signals which correspond in frequency to that of a station. The horizontal and

vertical scanning frequencies of the receiver must be the same during convergence adjustments as when a station's signal is received. If the generator does not produce such sync signals, the dynamic convergence waveforms developed by the color receiver will differ and consequently misconvergence will result when a station's signal is received. When considering a convergence generator, the following points are worthy of investigation: type of patterns provided, pattern stability, portability, and simplicity of operation.

The second of the three special instruments is a color-bar generator. Some test-equipment manufacturers have combined both convergence and color-bar generators in one unit. A combined instrument has the advantage of lower total cost, small size, and convenience of use.

The primary function of a color-bar generator is to supply color test signals for the alignment and troubleshooting of the receiver. Service using such a generator is much more realistic than with any equipment previously used for monochrome service. A fixed color signal with known chroma phases and amplitudes, such as that produced by an NTSC color-bar generator, is much more advantageous than a constantly changing signal from a station transmitting color. Also, a color-bar generator will provide constant scope waveforms throughout the receiver.

Available from most color-bar generators is a composite color video signal (Fig. 3) for signal injection purposes anywhere in the receiver after the video or chroma detector. This color video signal is available in either positive or negative polarity, is usually variable in amplitude, and is useful for signal tracing and servicing in the color, video, and sync circuits. For this reason a color-bar generator is a must for color receiver servicing requirements.

There are basically two types of color-bar generators available; NTSC and rainbow. An NTSC color-bar generator produces a compatible signal. This simply means that the signal produced is usable for both monochrome and color receiver servicing. An NTSC color-bar generator is therefore equivalent to a station transmitting color, which may also be received in black and white.

Fig. 3 shows the video waveform of an NTSC generator. Notice the signals available. They include horizontal blanking and sync, color burst (at 3.58 mc.), chrominance, and luminance signal. The latter is roughly indicated by the lighter area at the centers of the bars representing the various colors.

A rainbow generator will usually produce a series of 10 color strips. Due to its basic design, it does not produce a compatible signal, nor can it reproduce white, distinct primary colors (red, blue, and green), or fully saturated colors. It also does not provide a monochrome signal, and the signal representing the color burst is not at 3.58 mc. For these reasons, the signal produced by such a generator is of little value for servicing in the monochrome circuits. It also has limitations in color servicing.

When considering a color-bar generator, then, the following points should be considered: type of color signal (NTSC or rainbow), whether the unit is combined with a convergence generator, whether a signal usable for monochrome testing is available, and simplicity of operation.

The importance of a wide-band scope for color servicing cannot be too strongly emphasized. Its value for color servicing far exceeds its value in monochrome work. It will show video, sync, and pulse waveforms more clearly and accurately, also indicating differences not distinguishable with a narrow-band scope. As an example, Fig. 3 represents the video waveform of an NTSC color-bar generator reproduced by a wide-band scope. If a narrow-band scope were used to view the identical waveform, the color burst and chrominance signals would not be distinguishable, and the horizontal sync and blanking, as well as the B-W signal, would appear somewhat distorted.

A scope must have a wide vertical-amplifier frequency response to reproduce the color burst and chrominance signals transmitted by a color station or produced by an NTSC color-bar generator. The color burst signal is at a frequency of 3.58 mc. and the chrominance signal contains frequencies between 3 and 4 mc. Therefore, a color scope must have frequency-reproducing capabilities in excess of 4 mc. to faithfully reproduce these. Flatness of this response, sensitivity, and sweep stability are also important.

Of the wide-band color scopes available, there are basically two types; single and dual bandwidth. Dual bandwidth also means dual sensitivity, since higher sensitivity will result when the bandwidth is restricted.

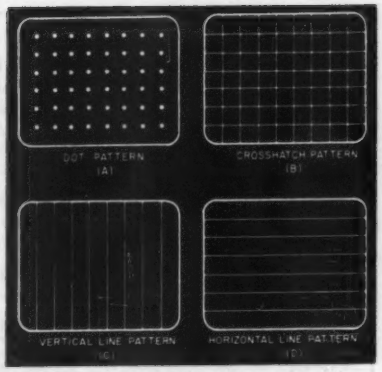


Fig. 1. A variety of patterns may be used for convergence adjustment.

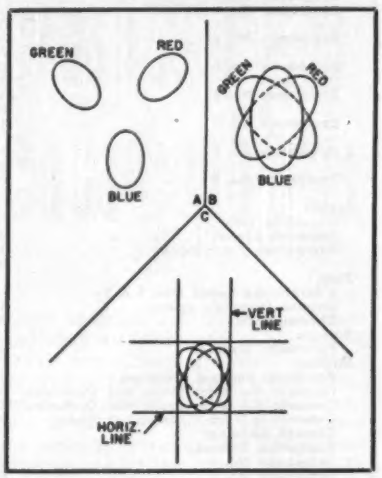


Fig. 2. Odd shape of color dots on CRT may complicate convergence procedures.

Once the instruments discussed are on hand, there remains the further question of how they are to be employed. The final article of this series will, accordingly, deal with service techniques for color receivers.

(To be concluded)

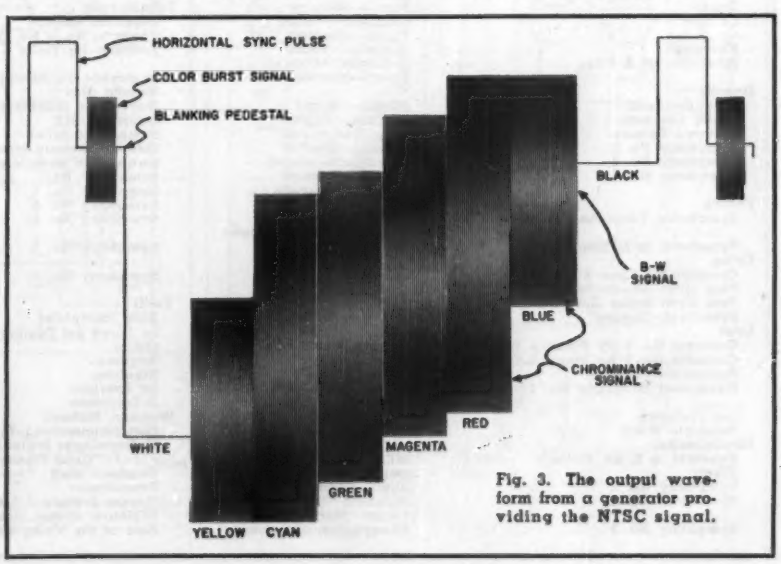


Fig. 3. The output waveform from a generator providing the NTSC signal.

CHRISTMAS RECORD BUYING GUIDE

Certain classical composers are acknowledged to be "popular" favorites with the public. The works of these composers are the most frequently performed in concert halls and recordings of their works greatly outsell all others. This guide will be confined to recordings of these "popular" composers. High fidelity of reproduction is the principal criterion for choice, coupled wherever possible with high performance standards. First recording listed is prime choice, others are good alternatives.

(For this month's record and tape reviews refer to pages 107 and 110.)

COMPOSER	TITLE	ARTIST AND LABEL
Beethoven		
	Concerto No. 1 for Piano and Orchestra	Rubenstein—Victor
	Concerto No. 2 for Piano and Orchestra	Rubenstein—Victor
	Concerto No. 3 for Piano and Orchestra	Backhaus—London
		Rubenstein—Victor
	Concerto No. 4 for Piano and Orchestra	Serkin—Columbia
	Concerto No. 5 for Piano and Orchestra	Rubenstein—Victor
	Symphony No. 1	Von Karajan—Angel
	Symphony No. 2	Toscanini—Victor
	Symphony No. 3	Klemperer—Angel
		Toscanini—Victor
	Symphony No. 4	Dorati—Mercury
		Von Karajan—Angel
	Symphony No. 5	Kleiber—London
		Dorati—Mercury
	Symphony No. 6	Paray—Mercury
		Kleiber—London
	Symphony No. 7	Reiner—Victor
		Paray—Mercury
	Symphony No. 8	Dorati—Mercury
		Scherchen—Westminster
	Symphony No. 9	Von Karajan—Angel
		Toscanini—Victor
Berlioz		
	Harold in Italy	Primrose—Columbia
	Romeo and Juliet	Munch—Victor
	Symphonie Fantastique	Dorati—Mercury
		Munch—Victor
Bizet		
	L'Arlesienne Suites Nos. 1 & 2	Paray—Mercury
	Carmen (complete opera)	Reiner—Victor
	Carmen Suite	Paray—Mercury
Borodin		
	Polovtsian Dances	Dorati—Mercury
Brahms		
	Academic Festival Overture	Boult—Westminster
	Concerto No. 1 for Piano and Orchestra	Rubenstein—Victor
	Concerto No. 2 for Piano and Orchestra	Rubenstein—Victor
	Concerto in D for Violin and Orchestra	Milstein—Capitol
	German Requiem	Lehmann—Decca
	Hungarian Dances	Rossi—Vanguard
	Symphony No. 1	Krips—London
	Symphony No. 2	Boult—Westminster
	Symphony No. 3	Dorati—Mercury
		Bohm—London
	Symphony No. 4	Paray—Mercury
		Kubelik—London
	Tragic Overture	Boult—Westminster
Chopin		
	Concerto No. 1 for Piano and Orchestra	Gulda—London
	Concerto No. 2 for Piano and Orchestra	Rubenstein—Victor
	Les Sylphides	Desormiere—London
	Polonaises for Piano	Rubenstein—Victor
	Etudes for Piano	Novaes—Vox
	Preludes for Piano	Novaes—Vox
	Nocturnes for Piano	Novaes—Vox
Debussy		
	Clair de Lune	Stokowski—Capitol
	Iberia	Paray—Mercury
	La Mer	Toscanini—Victor
		Paray—Mercury
	Nocturnes	Monteux—Victor
	Afternoon of A Faun	Stokowski—Capitol
		Paray—Mercury
Dvorak		
	Cello Concerto	Starker—Angel
	Violin Concerto	Milstein—Capitol
	Slavonic Dances	Kubelik—London
	Symphony No. 2	Kubelik—London
	Symphony No. 4	Sawallisch—Angel
	Symphony No. 5	Kubelik—London
		Kubelik—Mercury
Franck		
	Symphonic Variations	Badura-Skoda—Westminster
	Symphony in D Minor	Paray—Mercury
Grieg		
	Concerto for Piano & Orchestra	Rubenstein—Victor
	Peer Gynt (Incidental Music)	Beecham—Angel
	Peer Gynt Suites Nos. 1 & 2	Rodzinski—Westminster
	Symphonic Dances	Van Remoortel—Vox
Liszt		
	Concerto No. 1 for Piano & Orch.	Rubenstein—Victor
	Concerto No. 2 for Piano & Orch.	Katchen—London
	Hungarian Fantasia	Ciffra—Angel
	Hungarian Rhapsody No. 2	Badura-Skoda—Westminster
	Les Preludes	Paray—Mercury
	Mephisto Waltz	Reiner—Victor
Mendelssohn		
	Concerto in E for Violin	Milstein—Capitol
	Elijah	Sargent—Angel
	Symphony No. 3	Boult—Westminster
	Symphony No. 4	Beecham—Columbia
		Dorati—Mercury
	Symphony No. 5	Mitropoulos—Columbia

COMPOSER	TITLE OF WORK	ARTIST AND LABEL
Mozart		
	Symphony No. 39	Reiner—Victor
		Klemperer—Angel
	Symphony No. 40	Reiner—Victor
	Symphony No. 41	Reiner—Victor
		Beecham—Columbia
Mussorgsky		
	Boris Godounov (Complete)	Christoff—Victor
	Night on Bald Mountain	Stokowski—Victor
	Pictures at an Exhibition	Kubelik—Mercury
Offenbach		
	Gaite Parisienne	Fiedler—Victor
Puccini		
	La Boheme	Tebaldi—London
	Madame Butterfly	Callas—Angel
	Manon Lescaut	Tebaldi—London
	Tosca	Callas—Angel
	Turandot	Tebaldi—London
Rimsky-Korsakov		
	Capriccio Espagnol	Paray—Mercury
	Coq d'or Suite	Dorati—Mercury
	Russian Easter Overture	Ansermet—London
	Scheherazade	Dorati—Mercury
		Ormandy—Columbia
Rossini		
	The Barber of Seville	Erede—London
Saint-Saens		
	Carnival of the Animals	Coward—Columbia
	Dance Macabre	Ansermet—London
	Concerto No. 3 for Violin & Orch.	Campoli—London
	Symphony No. 3 (Organ Symphony)	Cluytens—Angel
Schubert		
	Symphony No. 7	Boult—Westminster
	Symphony No. 8	Von Karajan—Angel
		Bohm—London
Schumann		
	Concerto in A for Piano & Orch.	Gieseking—Angel
	Symphony No. 1	Kletzki—Angel
	Symphony No. 2	Paray—Mercury
	Symphony No. 3	Schuricht—London
	Symphony No. 4	Paray—Mercury
Strauss, Johann		
	Die Fledermaus	Krauss—London
	Gypsy Baron	Kunz—Vanguard
	Waltzes	Dorati—Mercury
	Wiener Blut	Schwarzkopf—Angel
Strauss, Richard		
	Death and Transfiguration	Reiner—Victor
		Knappertsbusch—London
	Don Juan	Reiner—Victor
	Ein Heldenleben	Dorati—Mercury
	Der Rosenkavalier	Gueden—London
	Der Rosenkavalier Suite	Dorati—Mercury
	Salome	Goltz—London
	Salome: Dance of the Seven Veils	Reiner—Victor
	Till Eulenspiegel	Dorati—Mercury
		Krauss—London
Tchaikovsky		
	Capriccio Italien	Dorati—Mercury
	Concerto No. 1 for Piano & Orch.	Gilels—Victor
	Concerto for Violin & Orch.	Campoli—London
		Heifetz—Victor
	Francesca da Rimini	Munch—Victor
	Marche Slav	Fiedler—Victor
	Nutcracker (complete ballet)	Dorati—Mercury
	Overture 1812	Dorati—Mercury
	Romeo and Juliet	Galliera—Angel
	Sleeping Beauty (complete)	Dorati—Mercury
	Swan Lake (complete)	Dorati—Mercury
	Symphony No. 1	Swarowsky—Urania
	Symphony No. 2	Beecham—Columbia
	Symphony No. 3	Boult—London
	Symphony No. 4	Sanderling—Decca
		Kubelik—Mercury
	Symphony No. 5	Dorati—Mercury
		Fricsay—Decca
	Symphony No. 6	Monteux—Victor
		Kubelik—Mercury
Verdi		
	Aida (complete)	Callas—Angel
	La Forza del Destino	Tebaldi—London
	Otello	Tebaldi—London
	Requiem	De Sabata—Angel
	Rigoletto	Del Monaco—London
	La Traviata	Monteux—Victor
	Il Trovatore	Del Monaco—London
Wagner, Richard		
	Gotterdammerung Funeral Music	Knappertsbusch—London
	Meistersinger Preludes	Paray—Mercury
	Parsifal Good Friday Music	Paray—Mercury
	Siegfried Idyll	Paray—Mercury
	Tannhauser	Munch—Victor
	Tristan Prelude & Liebestod	Paray—Mercury
	Walkure: Magic Fire Music	Munch—Victor
	Ride of the Valkyries	Paray—Mercury

Preamp Kit Features

PRINTED CIRCUITS

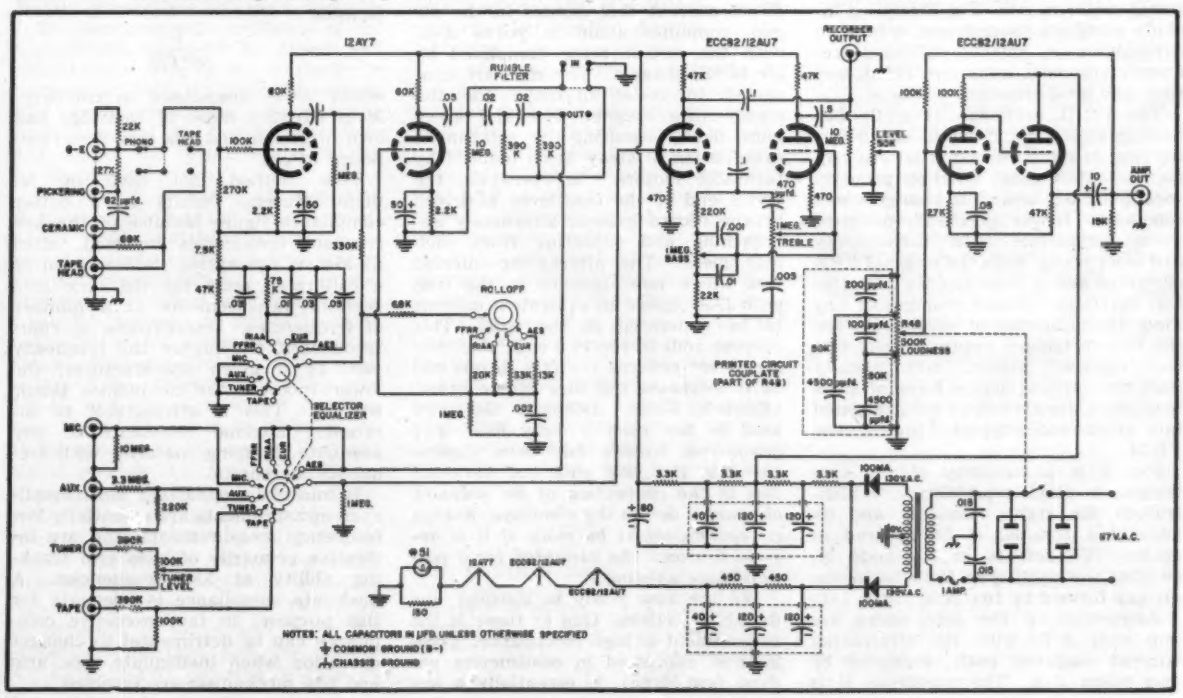
Front and top views of hi-fi preamplifier assembly. To the left may be seen the printed circuit equalizer section. An additional board is used for tube circuitry.

Novel printed circuit equalizer switches and circuit boards reduce construction time and possible errors.

ONE of the latest additions to the high-fidelity component field is a preamp kit made by *Allied Radio* under the "Knight-Kit" brand. One feature is the application of four individual printed circuit assemblies. Two of these are actually switches, one being the selector—low-frequency equalizer unit and the other being the high-frequency equalizer. The printed circuit switches are the first of their kind that we have seen in equipment of this type. Normal switch contacts are riveted to a board and the connecting leads, printed on the board, terminate in an array of pin jacks. These pin jacks simply slip into pre-aligned holes on one of the circuit boards. In addition to these two switches there

(*Continued on page* 152)

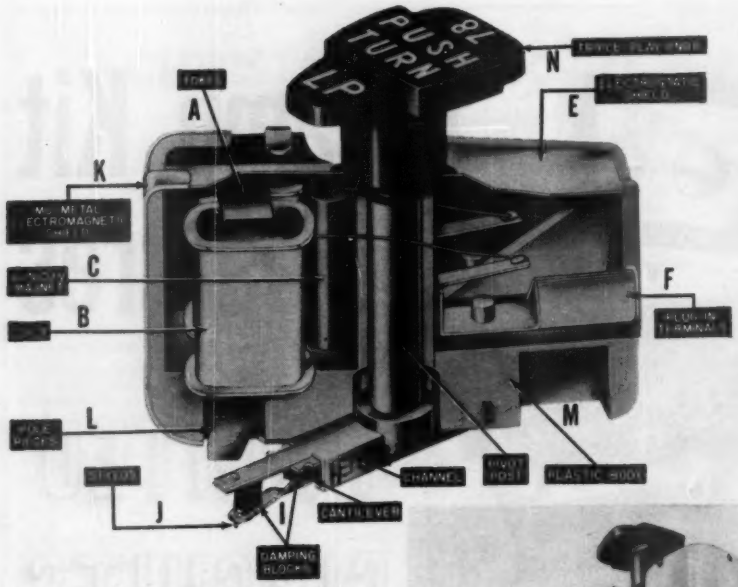
Schematic diagram of preamplifier. Low noise, non-microphonic tubes are used with d.c. across all heaters.



High compliance in itself is not a criterion for minimum record wear. The most destructive record wear

measure the response from 1 kc. to 20 kc. This has a constant velocity characteristic and for magnetic pick-

New Hi-Fi Reluctance Phono Cartridge



↑ **Fig. 1. Cut-away view of cartridge with important parts identified here.**

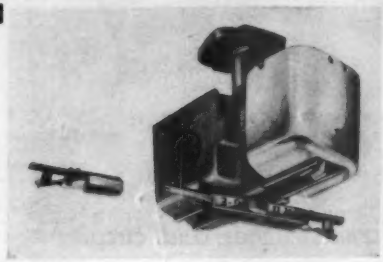


Fig. 2. The dual-stylus type of → the VR-II cartridge with its clip-in tips.

By **ROY DALLY**
Product Engineer, Phono Pickups
General Electric Company

Better high-frequency response, less tracking pressure with new replacement for G-E's RPX reluctance cartridge.

CERTAIN objectives are common to all pickup designs, tempered where necessary to meet practical operational requirements. The objectives include adequate compliance, minimum dynamic mass, smooth extended frequency response, minimum IM distortion, and good transient response.

The VR-II cartridge (Fig. 2) has been designed about these objectives, keeping in mind the essential requirements that it must function properly with presently available changers and tone-arms. It was specifically designed to be compatible, both mechanically and electrically, with the original RPX cartridge and it does replace the original cartridge without changes of any kind. The difference in weight between the two cartridges, approximately two and one-half grams, automatically fixes the vertical needle force of a six to seven gram system to the suggested four gram force suggested for the new VR-II.

Fig. 1 is a cut-away of the cartridge. In playing position (not illustrated) the stylus assembly and its associated channel *G* lie secured in double "V" detents in the body *M*, causing the cantilever *H* to be in the air gap formed by two pole pieces *L-L*.

Assembled on the pole pieces are two coils *B-B*, with the alternating current magnetic path completed by two yokes *A-A*. The cantilever *H* is made of ferrous material and it acts as a flexible extension of the magnet. When the pickup is not in use, the direct current flux divides in the air gap, combines again in yokes *A-A*, with the circuit being completed by air to the magnet. The coils are connected in series opposing for the steady-state magnet flux and stray hum fields, resulting in substantial cancellation of stray fields induced by turntable motors. In operation, the stylus end of the cantilever is driven by the record groove, alternately approaching and departing from each pole piece. The alternating current flux which now appears in the iron path *L-A* causes an equivalent current to be generated in the coils. This current adds in the two coils since the cantilever reduces the flux in one coil as it increases the flux in the other. (*Editor's Note: Although the wire used in the coils is very fine—#44 gauge—no trouble has been experienced in the field with coil burn-out due to the connection of an ordinary ohmmeter across the windings. Such a connection might be made if it is desired to check the cartridge for a possible open winding.*)

We are now ready to consider our design objectives. One of these is the requirement of high compliance. Compliance, expressed in centimeters per dyne (cm./dyne), is essentially a low frequency phenomenon, as ordinarily measured. One common method makes use of tone-arm resonance, wherein the cartridge to be measured is mounted in an arm and driven either with frequency records or a driver. The fundamental resonance of the system is used in the following formula:

$$K = \frac{1}{4\pi^2 f^2 M}$$

where K is compliance in cm./dyne, M is effective mass of cartridge and arm in grams, and f is tone arm resonance in cps.

This method, not used by all manufacturers, results in a better compliance figure because of the low resonant frequencies involved, often as low as ten cycles. Substitution of a calibrated mass for the tone arm permits measurements at a number of frequencies. Disregarding spurious resonances, the higher the frequency used by a given manufacturer, the lower (poorer) the compliance factor will be. This is attributable to increasing internal resistance of any adequate damping material with frequency increase.

It must be emphasized that compliance measurements are essentially low frequency measurements, and are indicative primarily of tone arm tracking ability at low frequencies. A moderate compliance is adequate for this purpose; in fact excessive compliance can be detrimental to changer operation when inadequate tone arm and trip mechanism are involved.

High compliance in itself is not a criterion for minimum record wear. The most destructive record wear occurs at high frequencies and involves other factors, including dynamic or effective mass of the moving system and damping and mechanical resonances. The VR-II moving system consists of a cantilever equipped with a stylus and damping blocks. Since a cantilever is essentially a tuned reed, quite capable of breaking up into any number of mechanical resonances, it becomes obvious that the design of the moving system is of utmost importance. Choice of material, proper cross-section ratio, length and conformation must all be carefully balanced to achieve smooth, wide-range reproduction.

A cantilever, when properly controlled, has certain advantages with respect to effective mass. At low frequencies, it acts as a beam, rigidly supported at one end. When force is applied at the free end, displacement occurs throughout its length to a diminishing degree, disappearing at the secured end. Under these conditions of operation, the effective mass of the VR-II system encountered at low frequencies is not a significant cause of record wear. As frequency is increased, the flexing point of the cantilever moves toward the stylus end. By careful location of the cantilever twist and damping material near the twist, only the front flat section of the cantilever moves laterally, from approximately 9 kc. through 20 kc. Thus the effective mass is greatly diminished at high frequencies, resulting in low record wear in this critical region. Application of controlled damping to this section by means of the front damping block produces a smooth high-frequency response. This results in excellent transient response.

The fundamental compliance of the unit is determined by the length and cross-section ratio of the cantilever in conjunction with the damping system. The necessary degree of restoring force essential to drawing the tone arm across the record is determined by the same factors.

Methods of measuring IM distortion in pickups involves the use of records which, unfortunately, are high in inherent distortion, varying from one to two and one-half per-cent. Such measurements therefore are inconclusive when the per-cent of distortion being indicated by the meter is within this range. Most good pickup designs fall within this category, including the VR-II, and for all practical purposes may be considered to be satisfactory. It is significant, however, that the VR-II reaches this area of fixed distortion at a low vertical needle force.

Fig. 6 shows the VR-II response from 30 cps to 20 kc. An *RCA* 12-5-49 record having an RIAA recording characteristic is utilized for measurements from 30 cps to 1 kc. The curve is corrected in accordance with the corrections included with the record. An *RCA* 12-5-67 pressing is used to measure the response from 1 kc. to 20 kc. This has a constant velocity characteristic and for magnetic pickups has no corrections. Both pressings are in commercial vinyl and present an accurate picture of factual performance.

A word of warning about frequency records. Fig. 3 shows the results of using five different types of records with the same pickup. All pressings are in vinyl and measurement conditions identical. There are other records available that have not been tested. All response claims made for the VR-II are based exclusively on *RCA Victor's* 12-5-49 and 12-5-67 pressings, with nominal manufacturing tolerances applied.

Fig. 4 shows responses with various loads. *Where interstage record compensation is used, the minimum load across the cartridge should be 100,000 ohms.* Larger values may be used. Note that if load resistors in the order of 25,000 or 50,000 ohms are used, these produce undesired treble roll-offs at 15 kc. of 5.5 and 3 db respectively. Since these resistance values are found in a good many preamplifiers that are designed for the variable reluctance cartridge, such units should be checked before installing the new cartridge.

Where it is desired to have an RIAA characteristic directly out of the cartridge from 1 to 20 kc., a 6200-ohm load should be used. This is the same value of cartridge load recommended for the early *G-E* cartridge. Fig. 5 shows the response with such a load, using the 12-5-49 record. Note that under this condition the cartridge may be shunted with as much as 1000 $\mu\mu$fd., without detrimental high-frequency attenuation or resonance effects. For any application that requires a long lead involving high capacitance, record compensation applied directly to the cartridge is recommended.

An electrostatic shield (*E* in Fig. 1) grounds the electromagnetic shield *K* and the moving system to one terminal. This eliminates body capacity effects, if the shield is touched, and effectively dissipates any electrostatic field built up about the stylus by vinyl records. An ungrounded moving system operating under dry atmospheric conditions can result in periodic static discharges, resembling and often confused with severe background noise.

The performance of the VR-II cartridge is readily apparent to the average listener by direct comparison; it is distinguished by peak-free, clean, high-frequency response. Mechanical reproduction, noise emanating directly from the moving system, is effectively reduced by means of a special damping medium. —30—

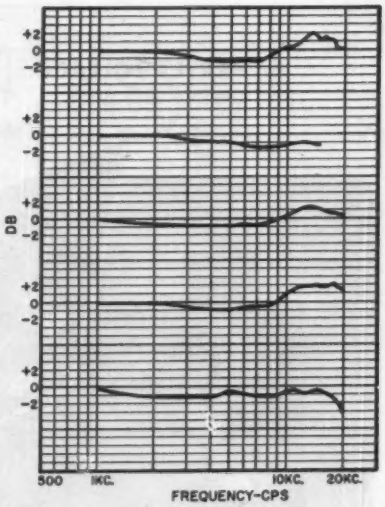


Fig. 3. Response of new cartridge taken under identical conditions with 5 different test records. Had the top 4 of these curves not been obtained from test records produced by the same company, even greater differences would have been apparent.

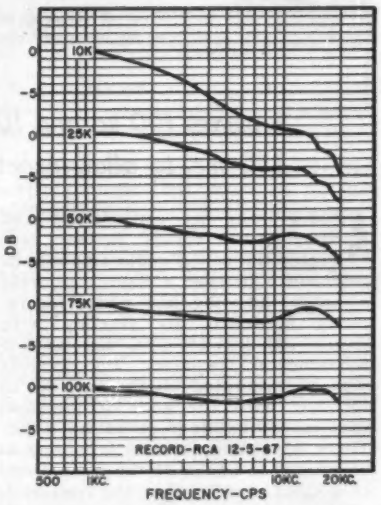


Fig. 4. Note how the output of the cartridge rolls off at the high end when small values of cartridge loading resistors are used. Therefore, when interstage record equalization is employed, the value of the cartridge loading resistor that is used ought to be at least 100,000 ohms.

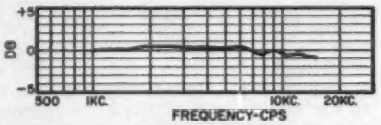


Fig. 5. Response of the cartridge above 1 kc. with a 6200-ohm load resistor. The RCA 12-5-49 RIAA test record was used.

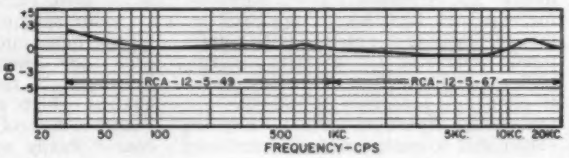
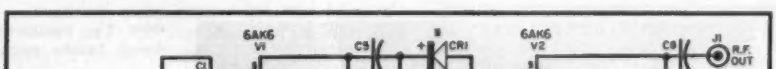


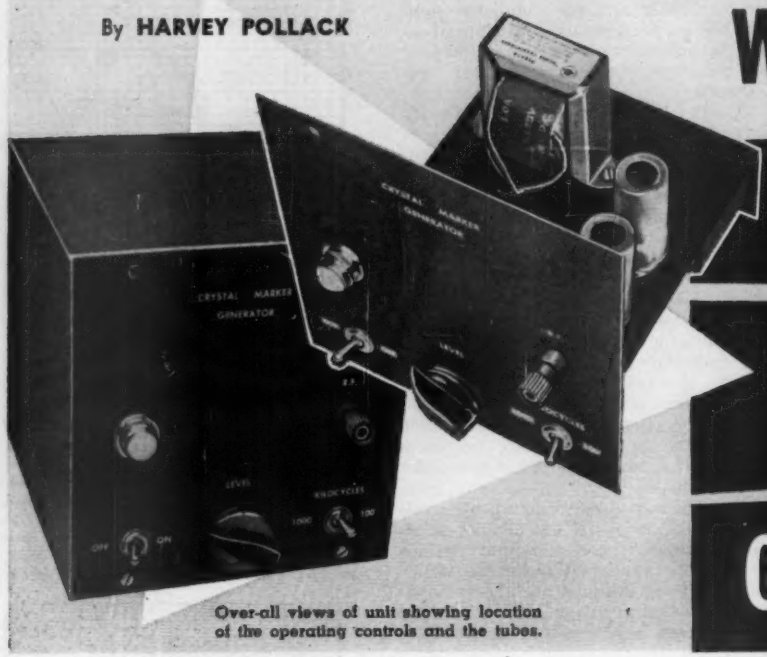
Fig. 6. This is the VR-II response from 30 cps to 20 kc. employing the two test records indicated.

for grounding components and tube socket lugs rather than depending upon connections to the metal chassis



By **HARVEY POLLACK**

Wide-Range Crystal Marker Generator



Over-all views of unit showing location of the operating controls and the tubes.

Provides 100 kc. and 1000 kc. check points up to 150 mc. to allow exact tuning by ham or SWL.

APART from its convenience and simplicity, a crystal marker generator offers the radio amateur or short-wave listener a highly accurate means of knowing just where his receiver is tuned. By starting with either 100 kc. or 1000 kc. as the fundamental frequency, the receiver may be calibrated all the way up to 150 mc. with the kind of precision that makes amateur operation a joy. There is nothing quite as satisfying as being able to advise at the remote end of a QSO exactly what the frequency of your contact is. Since the edges of most of the amateur bands are multiples of 100 kc., the marker generator provides a precise method for locating the band edge so that operation in these desirable spots can be carried on with confidence.

Radio amateurs who have used straightforward 100 kc. crystal oscillators are aware of their deficiencies: it is difficult to obtain enough signal strength on the higher frequencies due to the attenuation of the higher-order harmonics, and 100 kc. signals become very *dense* on most receivers above about 20 mc., making it almost impossible to identify one particular harmonic. By incorporating the provision for separate 1000 kc. output, and by intensifying the harmonics with a harmonic generator *and* a harmonic amplifier, identification becomes relatively easy. Intervals of 1000 kc. are far enough apart on virtually any receiver dial to make confusion unlikely and once these harmonics are identified, it is no problem at all to count off the 100 kc. intervals above and below the 1000 kc. markers.

The marker generator described here utilizes a special *Valpey* crystal assembly that contains both a 100 kc. and a 1000 kc. unit. Changeover from one frequency to the other is handled by a single-pole, single-throw switch of the common variety. There is absolutely no tendency for both crystals to oscillate simultaneously, a defect that is quite common in combination bars designed for both fundamental and overtone applications. The oscillator circuit recommended by the crystal manufacturer, wired in unmodified form, utilizes standard r.f. chokes as tuning inductances thus making coil winding unnecessary. It is followed by a crystal diode (1N34A) that rectifies the r.f. output and provides a waveform that is much richer in harmonics; the diode output is fed to a harmonic amplifier stage designed to intensify the high-order harmonics. Signal output is developed across a 1 mhy. r.f. choke which serves as the plate load for the harmonic amplifier and is coupled to the receiver through a 100 $\mu\mu$fd. ceramic disc capacitor. A cathode-bias gain control incorporated in the harmonic amplifier stage governs the output level to avoid "swamping" the incoming signal against which a beat-note is desired. Further control of signal level is, of course, easily accomplished by changing the coupling at the receiver end.

The entire instrument is contained in a 6" x 6" x 6" utility cabinet, making up into a compact unit yet one that has plenty of room to spare for comfortably accommodating all the components. The filaments and power supply are wired in first; this section should be tested before proceeding. Note that only half the power transformer high-voltage secondary is used. This type of transformer will provide either 125 volts r.m.s. or 250 volts r.m.s. depending upon its connection. In the original design, it was felt that possibly the need would arise for a higher supply voltage in the event that the high-order harmonics were not what they should be. In this case, the entire h.v. secondary would be put to use and the selenium rectifier changed to a 230 volt r.m.s. type. As it turned out, however, ample output was realized for both the 100 kc. and 1000 kc. settings right up to the 144 mc. amateur band with only half the secondary working.

Although the wiring is not particularly critical, all r.f. components should be positioned to permit minimum lead length. Rigidity is important; thus the use of terminal strips for the support of the small parts is desirable. Both the crystal assembly and the tiny 25 $\mu\mu$fd. tuning capacitor are secured to the rear apron of the built-in chassis while the remaining parts are located toward the front of the unit. For optimum performance, use only high quality ceramic capacitors, steatite tube sockets with shields, and a good grade of bypass capacitors and resistors. It is strongly urged that a short ground bus be used

← Tiny bobbin of wire used in the Ferristor, shown beside vacuum tube for comparison.

for grounding components and tube socket lugs rather than depending upon connections to the metal chassis for this purpose. As a final suggestion in the construction of the crystal marker generator, the plate load of the harmonic amplifier may be reduced in inductance as required if you are specifically interested in high intensity high-order harmonics. The value chosen in the unit pictured here was determined experimentally and is an excellent compromise for all of the amateur bands.

Operation

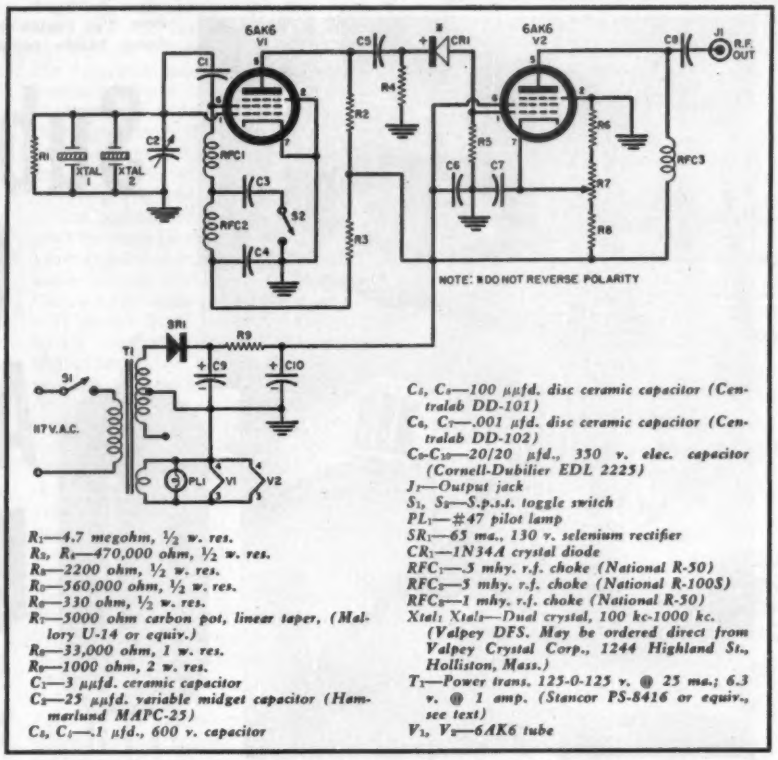
The 0.5 mhy. r.f. choke (RFC_1) is the tuning inductance for the 1000 kc. crystal. With S_2 closed, the other inductance (RFC_2) is effectively short-circuited for r.f. by C_3 and C_4 so that RFC_1 is the only coil in the crystal circuit. When S_2 is open, however, the r.f. ground return occurs through C_4 with both RFC_1 and RFC_2 in series serving as the 100 kc. tank circuit. The screen grid of the oscillator tube is the oscillating anode; the necessary amount of feedback to sustain oscillation is obtained through the 3 μμfd. capacitor, C_1. C_2 is a midget variable used to tune the crystal over a limited range for zero-beating against WWV as will be described later. Output from the oscillator plate is taken through C_5 and applied to the 1N34A crystal harmonic generator. Amplification of harmonics occurs in the 6AK6 stage that follows CR_1, output level being controlled by the setting of R_7. RFC_3 is the "compromise" plate load, and coupling to the r.f. output terminal is accomplished through C_8.

Testing and Adjustment

Before applying power, run through the standard ohmmeter test procedures to make certain that there are no heater or "B+" to "B—" shorts. Turn the marker generator on and, while it is heating up, tune your receiver to WWV on the frequency that gives reliable signal strength. Set generator for 100 kc. output.

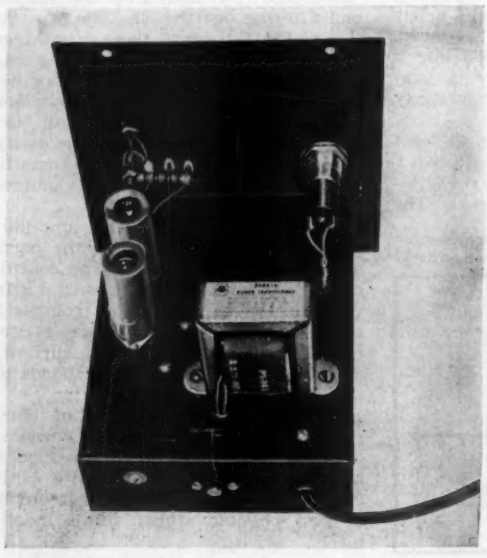
WWV in Washington, D. C. (and WWVH in Puunene, T. H.) broadcast continuous standard frequency and time signals. The former is operated by the Central Radio Laboratories at the National Bureau of Standards; the transmitted frequencies are accurate to two parts in 100 million on the following frequencies: 2.5, 5.0, 10.0, 15.0, 20.0, and 25.0 mc. WWV is generally very easy to identify because clock-like ticks are heard precisely on the second; at the time you tune in, the carrier may or may not be modulated by a 440 cps or 600 cps tone. Wait for the interval when modulation is absent and then carefully zero-beat the marker generator against the carrier. If your receiver has an S-meter, its slow pulsations will help to indicate when zero beat is being approached. If you are using any WWV frequency except 2.5 mc., the 1000 kc. output of the marker gen-

(Continued on page 179)



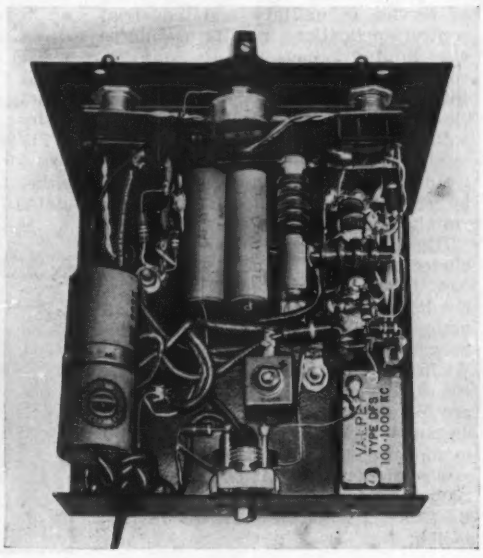
R_1—4.7 megohm, ½ w. res.
R_2, R_4—470,000 ohm, ½ w. res.
R_3—2200 ohm, ½ w. res.
R_5—560,000 ohm, ½ w. res.
R_6—330 ohm, ½ w. res.
R_7—5000 ohm carbon pot, linear taper, (Mallory U-14 or equiv.)
R_8—33,000 ohm, 1 w. res.
R_9—1000 ohm, 2 w. res.
C_1—3 μμfd. ceramic capacitor
C_2—25 μμfd. variable midget capacitor (Hammarlund MAPC-25)
C_3, C_4—.1 μfd., 600 v. capacitor
C_5, C_8—100 μμfd. disc ceramic capacitor (Centralab DD-101)
C_6, C_7—.001 μfd. disc ceramic capacitor (Centralab DD-102)
C_9-C_{10}—20/20 μfd., 350 v. elec. capacitor (Cornell-Dubilier EDL 2225)
J_1—Output jack
S_1, S_2—S.p.s.t. toggle switch
PL_1—#47 pilot lamp
SR_1—65 ma., 130 v. selenium rectifier
CR_1—1N34A crystal diode
RFC_1—.5 mhy. r.f. choke (National R-50)
RFC_2—5 mhy. r.f. choke (National R-100S)
RFC_3—1 mhy. r.f. choke (National R-50)
$Xtal_1$ $Xtal_2$—Dual crystal, 100 kc-1000 kc. (Valpey DFS. May be ordered direct from Valpey Crystal Corp., 1244 Highland St., Holliston, Mass.)
T_1—Power trans. 125-0-125 v. @ 25 ma.; 6.3 v. @ 1 amp. (Stancor PS-8416 or equiv., see text)
V_1, V_2—6AK6 tube

Complete schematic diagram and parts list for the crystal marker generator.



← Top view of chassis with the cabinet removed to show placement of two shielded tubes employed and power transformer.

Underside of → unit showing the placement of the various components. The special double crystal unit is at lower right corner.

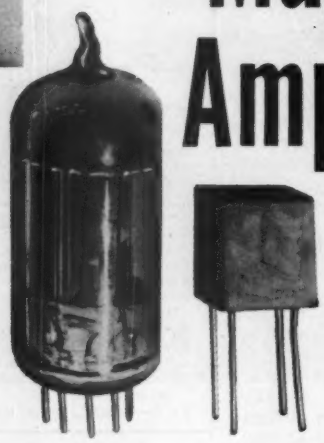


In ferroresonant operation a capacitor is selected to resonate with the partially saturated carrier winding in-

varistor associated with the "active" unit has the largest current through it. Thus it will conduct the most when

← Tiny bobbin of wire used in the Ferristor, shown beside vacuum tube for comparison.

Subminiature Magnetic Amplifiers



By
A. HUGH ARGABRITE
Patent Engineer
Berkeley Div., Beckman Inst., Inc.

New "Ferristor," small, ultra-fast saturable reactor, has high reliability for industrial automation needs.

THE demand for reliability in electronic equipment is constantly increasing. This demand has revived interest in one of the earliest practical amplifiers of electric signals—the magnetic amplifier.

One of the first models was built by the famous American radio pioneer, E. F. W. Alexanderson, over forty years ago. By 1945 the magnetic amplifier had proven itself dependable by years of service in military and industrial control applications, but its usefulness was limited because of its long response time. This slowness was due to the necessarily low "carrier" frequencies. The magnetic amplifier "carrier" is basically the same as the carrier used in radio broadcasting. A relatively high frequency wave is modulated by or "carries" the lower frequency "intelligence" or desired signal.

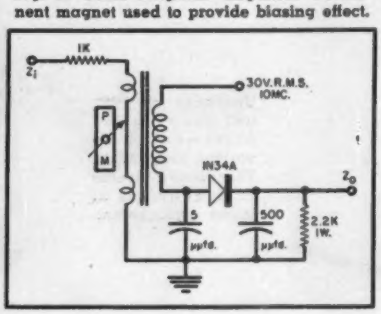
High core-material losses had precluded the use of high carrier frequencies. But now, development of the new low-loss, high-permeability ferromagnetic alloys has made magnetic amplifiers practical for electronic circuits. With the reduction of core losses, carrier frequencies up to 10 megacycles are possible. This gives magnetic amplifiers the fast response required in modern electronic instrumentation.

One of these new units is the "Ferristor" saturable reactor, made by the *Berkeley Division* of *Beckman Instruments, Inc.* It is a tiny device, not much larger than the eraser on a pencil. Technically it is a subminiature, ultrafast saturable reactor.

The "Ferristor" reactor is very simple in construction. It has two solenoid-type windings on a magnetic core. The inner, or carrier-current, winding has a few hundred turns of very fine copper wire. The outer, or control, winding has from one thousand to four thousand turns, depending on its intended use. The core is a few turns of sheet magnetic material, 1/8000 of an inch thick, rolled into a scroll. The finished assembly is completely sealed by "potting" it in epoxy resin.

These units can be used in at least two fundamentally different ways, either as magnetic amplifiers or as bistable ferroresonant elements. The latter use requires only one winding however.

Fig. 1. Basic magnetic amplifier. Permanent magnet used to provide biasing effect.



When this reactor is used as a magnetic amplifier, Fig. 1, a small load capacitor is placed in series with the carrier winding. Changes in control current vary the core permeability. This changes the effective inductance of the carrier winding. The carrier current is thus linearly modulated by the waveform of the control current. The magnitude of the carrier current and the amplitude of the r.f. output (across the load capacitor) vary in step. The amplified input waveform is "recovered" by rectifying the output and filtering out the r.f. The orientation of the rectifying diode determines whether the output is in- or out-of-phase with the input. The unit amplifies because the carrier-current variations are much larger than the control current changes. The extreme sensitivity of magnetic amplifiers enables them to amplify signals weaker than vacuum-tube shot noise.

The parts of a magnetic amplifier circuit may be compared to the parts of a vacuum-tube circuit. The control current corresponds to the control grid voltage; the carrier supply compares to the "B+" supply; the carrier current is analogous to the plate current; and the load impedance corresponds to the plate load.

The other basic application of "Ferristor" reactors employs the phenomenon of ferroresonance to produce a bi-stable characteristic. With this characteristic they can maintain either of two possible stable states indefinitely.

In ferroresonant operation a capacitor is selected to resonate with the partially saturated carrier winding inductance near the applied frequency. The resulting circuit has an S-shaped curve of voltage *versus* current. See Fig. 2. The capacitive reactance is constant with increasing current. But when the current through the iron-cored carrier winding is increased it becomes saturated. This decreases its effective inductance and the inductive reactance of the circuit.

Over a limited range, either of two different stable values of current can exist, for one given voltage. In circuit operation this voltage is actually the r[illegible] supply voltage. The intersections [illegible] the curves of power supply output and positive-slope circuit impedance are the two stable states. In the low current, or non-saturated state, the circuit is inductively reactive. In the high current, or saturated, state it is capacitively reactive.

In ferroresonant operation the control current does not flow constantly. Instead trigger pulses of control current are used to induce partial saturation of the core. It can be saturated by an external magnetic field, by d.c. in the control winding, or by r.f. in the carrier winding (which makes it capable of self-saturation).

A d.c. trigger pulse is applied through the control winding to raise the carrier current to the high state. The trigger pulse can be of either polarity, since both will temporarily reduce inductance. To make it change states, the core must be partially saturated to the point where any current increase decreases the inductance enough to drop the output voltage. Thus a pulse causes the current to regeneratively jump to the stable high current point. The interdependence of low inductance and high current keeps the circuit latched in this state of self-saturation. The unit cannot return to the low-current state until its supply voltage is reduced below the level where self-saturating current flow starts.

A ferroresonant flip-flop can be constructed by running two reactors in parallel. They must have a common coupling element—capacitor or triggering reactor—to the r.f. supply voltage. If memory and gating circuitry are added, the flip-flop can be operated with a single input.

An extended version of the flip-flop is the ring counter, Fig. 3, composed of several reactors operated in a closed loop. The ring counters are connected to the supply voltage through a common coupling element. Its value is chosen so only one unit at a time can draw high current. If two or more try to jump high, the extra current through the common coupling tends to drop the voltage so neither can be high.

The action in a ring counter is not random. In one common circuit, each unit has a directive circuit to transfer the high current or "active" state from one stage to the next stage in turn with each successive input pulse. The varistor associated with the "active" unit has the largest current through it. Thus it will conduct the most when the ring is pulsed. This increased current also flows in the control winding of the unit following. The new unit then goes into the high current state and the previous unit is forced out because of the action of the common coupling element.

The action of the stages in a ring counter may be compared with several glow regulator tubes in parallel across some voltage through a common resistor. As the voltage is raised, one tube will strike first, lowering the voltage to its regulated value. This prevents the other tubes from firing since the voltage has been reduced below their firing potential.

These units can be used in a one-shot multivibrator circuit. See Fig. 4. This circuit generates a constant-width output pulse and steepens the leading and trailing edges of a slow pulse input. The one-shot circuit is made from the magnetic amplifier circuit by adding a capacitor and resistor in series from the output to the input. The diode is oriented for in-phase output. The output pulse width is determined by the discharge time of the resistor and capacitor.

The circuit is triggered by an input pulse which induces partial saturation. Regeneration causes the carrier current to jump to the fully saturated state. A change at the output is reflected back to the input where it adds to the original input signal. This additive action takes the output practically instantaneously to its saturated value, where no further change is possible. While current from the capacitor keeps the core saturated the output stays in the high state. But as soon as the charge leaks off, the output drops back to the low state. This circuit can put out 25-volt, 4-microsecond pulses into a 1000-ohm load. This can be altered with bias changes. Bias can also be used to cause the circuit to trigger at a particular point on the input wave. The circuit shown requires a 15-volt positive pulse drive and puts out a pulse 40-microseconds wide.

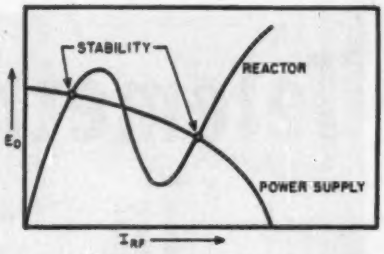


Fig. 2. Curves of ferroresonant operation.

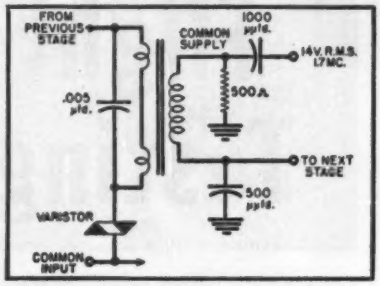


Fig. 3. Typical ring counter stage. The varistor is used for circuit stability.

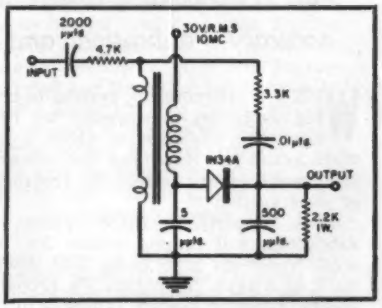


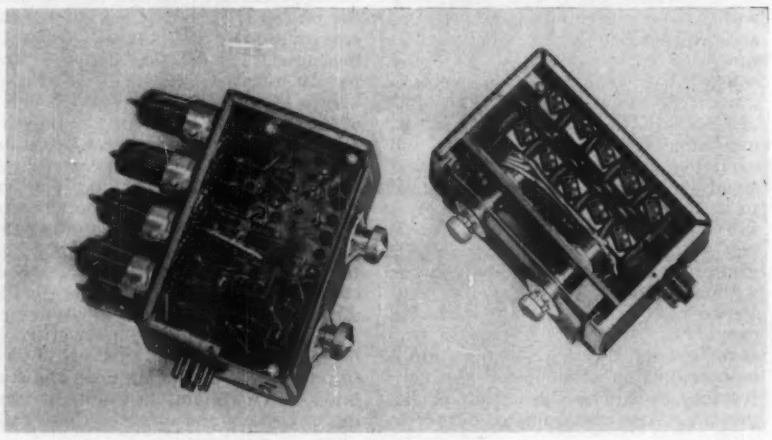
Fig. 4. Typical one-shot multivibrator.

A current discriminator, Fig. 5, which generates rapidly changing waveforms from slowly varying input waveforms, can also be made from these reactors. It is the analogue of the familiar vacuum-tube voltage discriminator, or the Schmitt trigger circuit.

To form this circuit positive feed-

(*Continued on page* 175)

Ferristorized decimal counting unit (right) compared with the vacuum-tube version.



sync pulse is obtained by connecting the first five segments of the commu-

Telemetry in Flight Testing

Equipped with complex electronic gear, this black-nosed gray supersonic jet (the Convair F-102A) was extensively flight tested by means of telemetry.

By **CHARLES M. DOWNS**
Engineering Dept., Convair (San Diego)

Part 2. Concluding article on telemetering systems discusses accuracy, calibration, and types of test equipment used.

WHEN a telemetering system is being explained to someone for the first time, one question which is always asked is, "How does the subcarrier frequency drift affect the accuracy of your system?"

In a properly operated system a subcarrier will remain within 3% of a set frequency after being shut down for 7 or 8 days. To obtain 3% repeatability, however, certain causes of drift must be minimized or eliminated. There are two general causes of SCO frequency drift: thermal or warm-up drift and externally stimulated drift. Much of the equipment in use today was designed for missiles and rockets where flight time was a matter of a minute or so. Therefore the components were required to remain stable for very short periods. The same components are now being used for flights lasting 1 or 2 hours. If allowed to reach operating temperature (a matter of a few minutes) and maintained within the manufacturer's temperature and acceleration limits, most oscillators will remain stable. Externally caused drift is a different problem. Caused by power and excitation voltage changes, this type of drift can be minimized by voltage regulation and excitation voltage monitors. Power supply regulation is easily maintained to ±2 volts of the nominal value. Most subcarriers are operated at 108 to 120 volt plate voltage. Regulation of the excitation voltage would have to be within a few hundredths of a volt. Various means are used to monitor the excitation voltage but the easiest way is to feed the excitation voltage into a voltage-controlled oscillator and subtracting or adding the output of the ground station discriminator output to the outputs of the other voltage-controlled channels.

The accuracy of a telemetering system, or any complex measuring system for that matter, is open to much argument and discussion. Since so many variables are involved, it is difficult to predict the accuracy of a system such as we are discussing. It may be said, then, that the accuracy can be determined only by repeated measurements, and then comparing the results with known quantities. It is possible, however, to establish certain tolerances which will reduce the chances of error.

The calibration of a system can be divided into two parts: routine or preflight calibrations, and in-flight automatic calibrations. These two calibrations in addition to a calibration of the receiving station immediately after each flight provide an over-all system calibration.

To accomplish a calibration of a voltage-controlled oscillator system, the pickup is actuated in measured increments and the output voltage is measured. This is then plotted as the pickup response curve. Voltages of known increments are fed to the input of the subcarrier oscillator and the output frequency is measured with an electronic counter. The subcarrier response curve may now be plotted. These two curves may be combined to produce an over-all calibration of the pickup status *vs* SCO frequency. In the case of resistance- or inductance-controlled oscillators, the calibration is a plot of pickup position *vs* output frequency. This type of calibration is performed at regular intervals of two to four weeks depending upon the stability of the system. In the flight testing of rockets and missiles, these calibrations are accomplished immediately before flight.

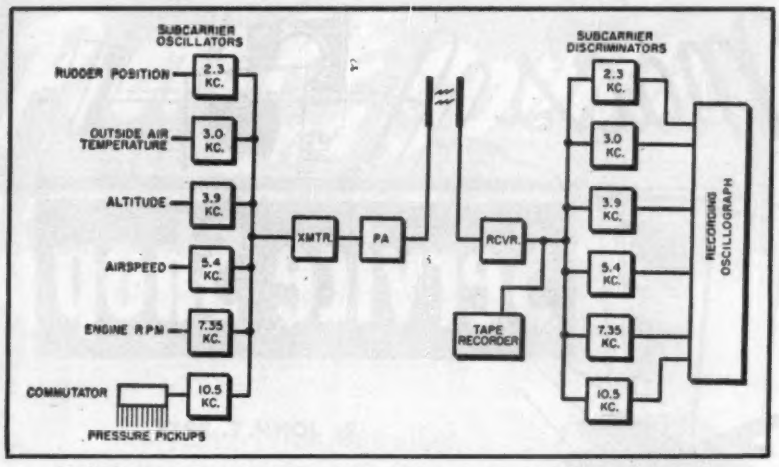
In-flight automatic calibration is accomplished by applying pre-measured voltages to the input of all the voltage-controlled oscillators. This can be done by a sequencer switching device, actuated by the pilot, which removes the pickup from the input of the SCO and inserts the calibration voltages in the desired increments and then returns the system to the "operate" condition. The sequence takes as little as ten seconds and can be started by the pilot between maneuvers so that little or no data is lost. An automatic calibration every 15 minutes will usually provide for normal drift of oscillators and excitation voltages.

Commutation

Commutators are an important accessory to telemetering systems. Essentially a motor driven rotary switch, they enable many (up to 60 in some systems) functions to be fed to one voltage-controlled oscillator. The switch contacts are made of silver-plated copper imbedded in a ceramic disc. The wiper, made of a special carbon compound, is rotated by the motor at speeds of 1 to 3½ revolutions-per-second. In practice, every other segment of the commutator is connected to signal ground to provide separation between data pulses and a zero reference point for the oscillograph record. The output of the commutator is a sequence of square waves of varying amplitude which are fed to the input of a voltage-controlled oscillator. The oscillator must have high enough frequency response to accept the output of the commutator. Relatively static functions are usually selected for commutation due to the sample rate of only 2 or 3 short pulses a second. A sync pulse is required in the output of the commutator if the data is to be decommutated on the ground. This

"Don't you believe it. That was a

sync pulse is obtained by connecting the first five segments of the commutator to the maximum signal voltage. Decommutation is accomplished by synchronizing another commutator with the one in the aircraft, feeding the commutated signal to the rotor, and extracting the decommutated signal from each segment. The commutated signal can also be recorded as a series of square waves using the sync pulse to identify the beginning of each commutation or "frame." The amplitude of each square wave is then measured to reduce the data. It is also possible to commutate the outputs of several SCO's. This type of commutation might be used to feed 15 3.9 kc. SCO's into one transmitter. Every other segment could be connected to a static 3.9 kc. signal to provide a reference line on the oscillograph record that is made.



Block diagram of a typical telemetering system employed for aircraft flight tests.

Test Equipment

The bulk of test equipment used in servicing telemetering systems is much the same as you would find in a well-equipped television repair shop. However, quite a few special units are required and the quality of the equipment, in general, must be much higher than usual.

The most interesting piece of "special equipment" is the "EPUT"[1] meter or electronic counter. Used as an audio-frequency meter, it gives a visual digital presentation of frequency from 1 to 100,000 cycles. Five vertical rows of digits (each row reading from bottom to top—0 through 9) are illuminated from behind by neon lamps. When a digit is to be presented to the operator it is illuminated by the lamp. A gate circuit with a 100 kc. crystal-oscillator time base allows the input signal to feed into cascade digital counters (binary scalers) for exactly one second. The gate then closes and the count is displayed for the desired length of time on the neon lamps. The counter then resets and the sequence is repeated. Manual operation of the gate by the operator enables the meter to count for any desired interval so that random pulses or a variable frequency can be totalized. The "period" function is the inverse of the count function. In period operation the meter displays the number of microseconds required for one cycle of the input frequency to occur. The unit may be checked at any time for accuracy and proper operation by feeding the internal 100 kc. oscillator to the regular count input and observing whether or not the meter counts out to 100,000. Since the measurement of frequency is the basis for reducing telemetered signals to data, the electronic counter is one of the most useful of all test equipment used in the setup and operation of a telemetering system.

Other types of digital indicating test equipment are available such as v.o.m.'s, r.m.s. and d.c. voltmeters, and multimeters. These may be used in addition to or in place of the more conventional instruments.

Test systems such as the *Bendix* "Subcarrier Analyzer[2]" are available which contain a multichannel bandpass filter and discriminator, electronic counter, oscilloscope, v.t.v.m., and any other equipment which may be required. These units, mounted in a portable rack which can be moved to the aircraft or missile, are invaluable for making last minute pre-flight checks, calibrations, and system troubleshooting.

After the telemetering signals pass through the receiver to emerge as frequency-modulated tones, there are two ways in which the data can be stored. It can be fed directly to the discriminators and recorded on electro-mechanical recorders, or it can be tape recorded and stored for reduction after flight. Some stations record the signals on tape while feeding them to the discriminators so that certain functions can be monitored during flight and the tape can be played back into

(*Continued on page* 144)

[1] The name "EPUT" is an abbreviation for "events per unit time" and is registered by Berkeley Division of Beckman Instruments, Inc. The name is often erroneously applied to other brands of electronic counters.

[2] Bendix Aviation Corporation, Pacific Division, North Hollywood, California.

Bendix TCS-24/26 commutator switch which may be used to make multiple measurements with a single subcarrier oscillator. The switch unit (top) is driven at 5 revolutions per second through a gear train by the small internally governed permanent magnet motor.

Internal view of Bendix voltage controlled subcarrier oscillator. Center Frequency and Deviation Sensitivity controls may be seen on the top of the unit. Two subminiature tubes are mounted inside the heat sink (center). Note the use of the printed board.

By **JOHN T. FRYE**

THE GOOD(?) OLD DAYS

IT WAS a bright winter morning, the first sunny one in days; and it was made all the brighter by the broad grin on Barney's freckled face as he stepped into the door of the service shop.

"You're looking mighty cheerful this morning," Mac, his employer, remarked as the youth shrugged his way into his shop coat. "What tickles you?"

"Oh, I was just talking with a fellow on my mobile on the way to work this morning, and I was doing a little griping about how hard it was to get out with my car transmitter when the band was crowded. He started telling me about his first mobile station. Seems he was in a National Guard unit that trained down around the Fort Knox, Kentucky, area; and this mobile of his consisted of three units: a mule carrying the transmitter, receiver, and power supply; a horse-mounted operator; and a horse-mounted generator turner. All three trained as a team. The transmitter and battery-operated receiver were mounted on the left side of a packsaddle in an inclined position for easy tuning and adjustment. The hand-cranked generator for powering the transmitter was on the right side. The operator wore earphones and had a key strapped to his right leg. Both of these made contact with the radio equipment through quick-disconnect devices just in case the mule decided to bolt. The operator rode on the left, and the power man rode on the right and turned the crank of the generator with his left hand. A whip antenna stuck up from the back of the packsaddle.

"Can't you just see this station in operation at a fast trot? I can't help but chuckle every time I picture it. If the operator didn't like the generator man, he could make life miserable for him by sending long-winded messages and keeping him on that crank. The range of the rig was only about a dozen miles at best, but it actually was operated in motion and was a true mobile.

"All of this took place in the early '30's. It certainly is a far cry from the modern helmet-radios used by the military. For that matter, modern servicing is a far cry from what it must have been then. You guys certainly had it pretty soft with the simple circuits used in the radios of that day. No FM, no TV, no complicated record-changers! You did not have to know how to align a ratio detector, converge a color tube, or repair a transistor set. I just wish I could have got into the game when it was that easy."

"Easy, Boy, easy!" Mac admonished. "Servicing back that far was not quite the gay lark you picture it. Take it from one who knows. We had our problems, too, and they gave us just as much headache as sweep circuits, convergence, and transistors do today."

"I don't see how that's possible," Barney said flatly.

"Well, for one thing, we didn't have the good service equipment we have today. When I began service work, I heated my soldering iron on a gas burner. Later, when I got my first clumsy electric soldering iron, I thought this was the last word; but if you had to use it today instead of your solder gun, you'd cry your eyes out. It was always cold when you wanted it hot and always hot when you wanted it cold. Just in the past few years service technicians have lost what used to be the insignia of the fraternity: soldering iron burns on the fingers and hands.

"Take meters for another example. We had no 20,000 ohms-per-volt meters. A few who could afford them had 'very sensitive' 1000 ohms-per-volt D'Arsonval-movement meters. The rest of us put up with inaccurate, insensitive, easily damaged moving-vane type meters. Oscilloscopes were still in the laboratories along with the v.t.v.m.'s. Signal tracers, other than a pair of earphones, were virtually unknown. New tubes were not nearly so consistently uniform in quality and characteristics as they are now; neither were tube-testers so accurate."

"But the circuits were simple," Barney stubbornly insisted.

"Don't you believe it. That was a period when every outfit had its own pet circuits. Nowadays you can pick up an a.c.-d.c. receiver and be pretty sure the circuit will stick close to the standard one; but back in the 30's you rarely got two sets in succession with even similar circuits. One set might be a straight two stages of TRF, tuned detector, and two stages of audio. The next might be a neutrodyne using three stages of TRF. The next might be one using the newfangled screen-grid tubes. Occasionally you would run across a really weird reflex circuit in which a couple of the tubes were called upon to do double duty as both r.f. and audio amplifiers, or one with a directly coupled Loftin-White audio amplifier with meter-pinning high voltages.

"Early superhets came up with some dillies in the way of circuit variations. The i.f. might be anything from 175 to 480 kilocycles. The oscillator and mixer might be separate tubes; or one tube, never intended to act as a converter, might be tortured into serving both functions in some sort of 'autodyne' circuit. The second detector might be a grid-leak type, a biased 'power detector,' or a diode type employing a grid and plate of a triode tied together to serve as a diode. Just to make things interesting, the i.f. amplifier might be regenerative with a variable capacitor to adjust the amount of feedback."

"Hm-m-m," Barney said; "maybe servicing back there wasn't such a snap at that."

"Keep in mind, too," Mac went on, "that we had very little up-to-date service literature. Some of the service magazines published diagrams, circuit analyses, and sensitivity and selectivity data on some of the more popular sets as they came on the market, and these were greatly prized. However, production changes were constantly being made, and many obscure companies were turning out sets; so you rarely had the diagram you needed. It was often necessary to trace out a circuit laboriously, wire by wire, and then try to figure out how it was intended to function."

"Most of the sets were pretty bulky and heavy, too, weren't they?"

"You can say that again! Lots of them were as large as a modern TV chassis; this was connected by a cable to a power supply that must have weighed thirty or forty pounds. When you got all this out of the cabinet, spread out on your bench, and wired together, you felt as though you had done a day's work. Most of the sets of that day used wet electrolytic capacitors from which the expansion seals soon rotted. That meant if you tilted the chassis on its side so you could see the wiring underneath, the electrolyte ran out and formed a sticky puddle on your bench that evaporated into a white powder.

"I've heard you gripe a lot about having to string some of the modern dial cables, but you don't know how difficult

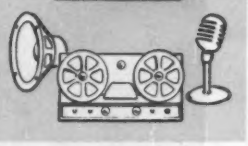
(*Continued on page* 170)

TRANSMIT *PICTURE and SOUND*

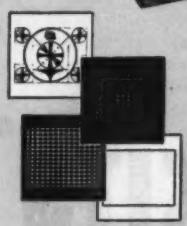
AT ANY TIME—TO ANY TV SETS

Displays any pattern, picture, or message for TV servicing or for closed-circuit telecasting

Provides crystal-controlled, full color rainbow display for complete color TV testing



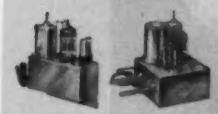
Provides FM sound carrier. Has built-in audio tone generator plus input for tape, tuner, mike



3 Slide Transparencies and One Clear Acetate Supplied with Dyna-Scan

Includes one Indian Head, one White Dot, and one White Line crosshatch pattern, plus one clear acetate for messages

MODEL 1000



C15 S16

B&K NEW MODEL 1050 DYNA-SCAN

PORTABLE VIDEO and AUDIO GENERATOR

THE FLYING SPOT SCANNER produces a composite video and sync signal that operates any standard black & white or color TV receiver, at any VHF television frequency. Reproduces your own test pattern or picture on the TV screen with high definition, anytime, anywhere, from any slide transparency—or transmits messages typed or written on clear acetate. Can be used with one or more TV sets or fed into a master or community antenna system. Maximum resolution capability is well in excess of 450 lines at video.

BUILT-IN COLOR-SCAN provides crystal-controlled, full color rainbow display of orange, red, magenta, blue, cyan, green. Enables you to test color sync circuits—check range of hue control, etc.

BUILT-IN AUDIO-SCAN provides FM sound transmission exactly like a TV station, 4.5 megacycles above video carrier, with modulation from any available audio source. Enables you to combine speech or music with the video display. Can be modulated with built-in 400 cycle tone generator for test signal or from external signal source such as microphone, tape recorder, FM - AM tuner, or from audio oscillator. Has built-in audio amplifier and volume control.

Facilitates servicing, installation or demonstration of black & white and color TV receivers. Provides closed-circuit TV system with both video and audio for commercial, industrial, and educational applications. Allows convenient stand-by and break-in, or distribution line check, for community antenna system operation.

Model 1050 DYNA-SCAN complete portable video and audio generator, with built-in Color-Scan and Audio-Scan. Includes 3 test pattern slide transparencies, one clear acetate and slide holder. Comes with 6 ft. r.f. cable. Size 16½ x 10⅝ x 9½ in. Net, **$259.95**

Model 1000 DYNA-SCAN picture and pattern video generator. Has all the features of the Model 1050 above, except without the Color-Scan and Audio-Scan sections. Net, **$199.95**

Color-Scan or Audio-Scan or both can easily be added to the Model 1000 at any time.

Model C15 COLOR-SCAN for Model 1000. Net, $19.95

Model S16 AUDIO-SCAN for Model 1000. Net, $29.95

Available from most Electronic Parts Distributors on easy time-pay plan.

See your B&K Distributor, or write for Bulletin 1050-N

B & K MANUFACTURING CO.
3726 N. Southport Ave. · Chicago 13, Illinois
Canada: Atlas Radio Corp., 50 Wingold, Toronto 10, Ont. Export: Ad. Auriema, 458 Broadway, New York 13, N.Y.

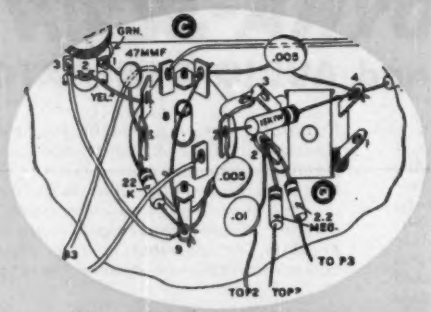
TIME PAYMENTS . . .

550 to 1600 kc. Quiet performance is assured by 6 db signal-to-noise ratio at 2.5 UV. Prealigned RF and IF coils eliminate the need for special alignment equipment. Incorporates

everybody's doing it!

FRANK PERKINS

Composer and arranger Frank Perkins listens attentively to his Decca hi-fi album "Music For My Lady" as its beautiful sounds are recreated with Heath high fidelity equipment. Music is a very important part of Frank's life, since his background includes composing and arranging musical scores for motion pictures, and for music publishers. Songs he has written include "Stars Fell on Alabama", "Emaline", "The Scat Song", "The Way I Feel Tonight", "After All These Years", and "Turn Back The Clock". Frank Perkins has discovered the beauty of Heath Hi-Fi sound . . . and the fun of "do-it-yourself" Heathkit construction. So, why don't you!



You'll get plenty of these detailed pictorial diagrams in your Heathkit construction manual to show where each and every wire and part is to be placed. Everything you do is spelled out in pictures so you can't go wrong. That's what makes it such fun!

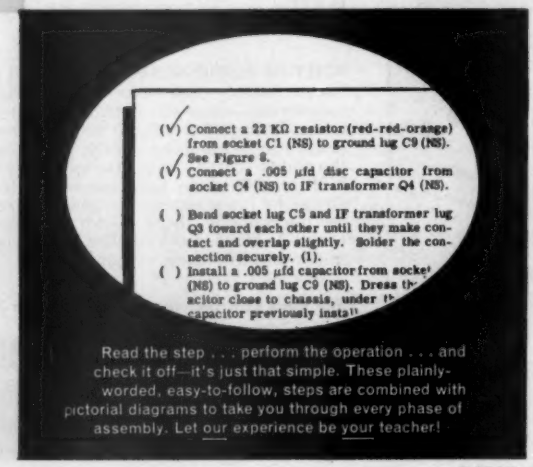
Heathkits®

By DAYSTROM

...fun to build and a thrill to own!

and here's why...

1. You get higher quality at lower cost by dealing direct, and by doing your own assembly.
2. You receive personal, friendly, service (before and after sale) for complete satisfaction.
3. You benefit from the latest in engineering designs because of our concentration on kit-form equipment only.
4. You may depend on performance as advertised—backed by Heath's world-wide reputation for quality.
5. You can take a full year to pay with the HEATH EASY TIME PAYMENT PLAN.


(√) Connect a 22 KΩ resistor (red-red-orange) from socket C1 (NS) to ground lug C9 (NS). See Figure 8.
(√) Connect a .005 µfd disc capacitor from socket C4 (NS) to IF transformer Q4 (NS).
( ) Bend socket lug C5 and IF transformer lug Q3 toward each other until they make contact and overlap slightly. Solder the connection securely. (1).
( ) Install a .005 µfd capacitor from socket (NS) to ground lug C9 (NS). Dress the capacitor close to chassis, under the capacitor previously install

Read the step . . . perform the operation . . . and check it off—it's just that simple. These plainly-worded, easy-to-follow, steps are combined with pictorial diagrams to take you through every phase of assembly. Let our experience be your teacher!

TIME PAYMENTS . . .

The Heath Time Payment Plan was designed for your convenience. Now, you can order the kits of your choice, and pay for them in small monthly installments. Write for full details.

HEATHKIT EXTRA PERFORMANCE 70-WATT AMPLIFIER KIT

For really high performance, with plenty of reserve power, the W-6M is a natural. The full 70-watts output will seldom, if ever, be required. However, this reserve insures distortion-less sound on power peaks. The W-6M will loaf along at normal listening levels and yet is always ready to extend itself when program material demands it, without the least amount of strain. The output circuit employs 6550 tubes with a special-design Peerless output transformer for maximum stability at all power levels. A quick-change plug selects 4, 8 and 16 ohms or 70-volt output and the correct feedback resistance. A variable damping control is also provided for optimum performance with any speaker system. Extremely good power supply regulation is possible through the use of a heavy-duty transformer along with silicon-diode rectifiers, which are noted for their very long life, and yet are smaller than a house fuse. Frequency response at 1 watt is ±1 db from 5 cps to 80 kc with controlled hf rolloff above 100 kc. At 70 watts output harmonic distortion is below 2%, 20 to 20,000 cps and IM distortion below 1%, 60 and 6,000 cps. Hum and noise 88 db below full output. In addition to high performance, its fine appearance makes it a pleasure to display in your living room. Proper layout of chassis insures ease of assembly by eliminating those cramped and difficult places to get at. Clear instructions—and top-quality components. Get started now and make this amplifier the heart of your hi-fi system. Shipped express only. Shpg. Wt. 50 lbs.

MODEL W-6M

$109.95

MODEL W-6: Consists of W-6M kit, plus WA-P2 preamplifier. Express only. Shpg. Wt. 59 lbs. $129.70

HEATHKIT HIGH FIDELITY FM TUNER KIT

This tuner can bring you a rich store of FM programming, your least expensive source of high fidelity material. It covers the complete FM band from 88 to 108 mc. Stabilized, temperature-compensated oscillator assures negligible drift after initial warmup. Features broadbanded circuits for full fidelity, and better than 10 uv sensitivity for 20 db of quieting, to pull in stations with clarity and full volume. Employs a high gain, cascode RF amplifier, and has AGC. A ratio detector provides high-efficiency demodulation without sacrificing hi-fi performance. IF and ratio transformers are prealigned, as is the front end tuning unit. Special alignment equipment is not necessary. Edge-lighted glass dial for easy tuning. Here is FM for your home at a price you can afford. Shpg. Wt. 8 lbs.

MODEL FM-3A

$25.95 (with cabinet)

HEATHKIT BROADBAND AM TUNER KIT

This AM tuner was designed especially for high fidelity applications. It incorporates a special detector using crystal diodes, and the IF circuits feature broad band-width, to insure low signal distortion. Audio response is ±1 db from 20 cps to 9 kc, with 5 db of preemphasis at 10 kc to compensate for station rolloff. Sensitivity and selectivity are excellent, and tuner covers complete broadcast band from 550 to 1600 kc. Quiet performance is assured by 6 db signal-to-noise ratio at 2.5 UV. Prealigned RF and IF coils eliminate the need for special alignment equipment. Incorporates AVC, two outputs, two antenna inputs, and built-in power supply. Edge-lighted glass slide-rule dial for easy tuning. Your "best buy" in an AM tuner. Shpg. Wt. 8 lbs.

MODEL BC-1A

$25.95 (with cabinet)

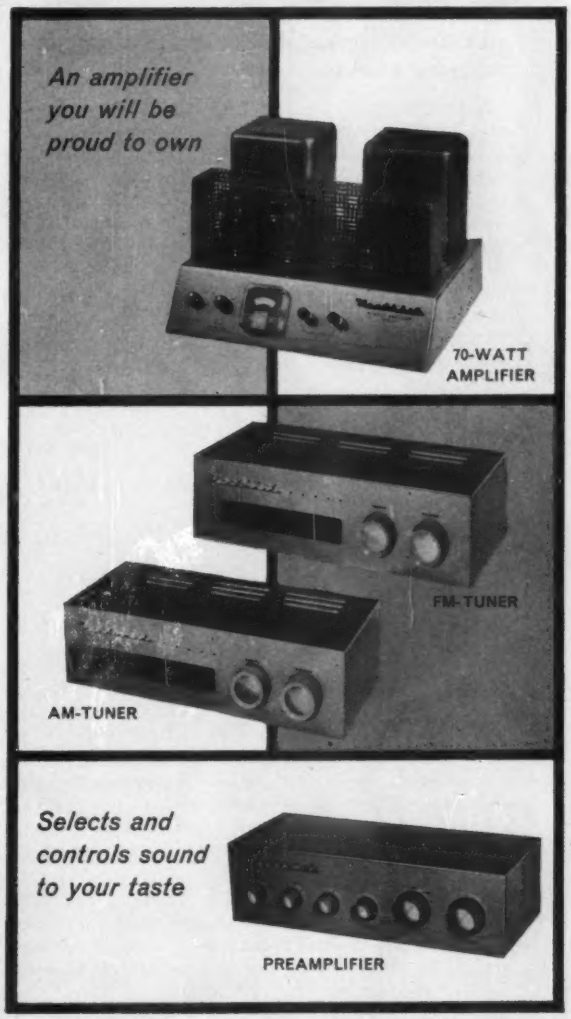
HEATHKIT MASTER CONTROL PREAMPLIFIER KIT

Designed for use with any of the Williamson-type amplifiers, the WA-P2 has five switch-selected inputs, each having its own level control to eliminate blasting or fading while switching through the various inputs, plus a tape recorder output. A hum control allows setting for minimum hum level. Frequency response is within ±1½ db from 15 to 35,000 cps. Equalization provided for LP, RIAA, AES, and early 78's. Separate bass and treble controls. Low impedance cathode follower output circuit. All components were specially selected for their high quality. Includes many features which will eventually be desired. Shpg. Wt. 7 lbs.

MODEL WA-P2

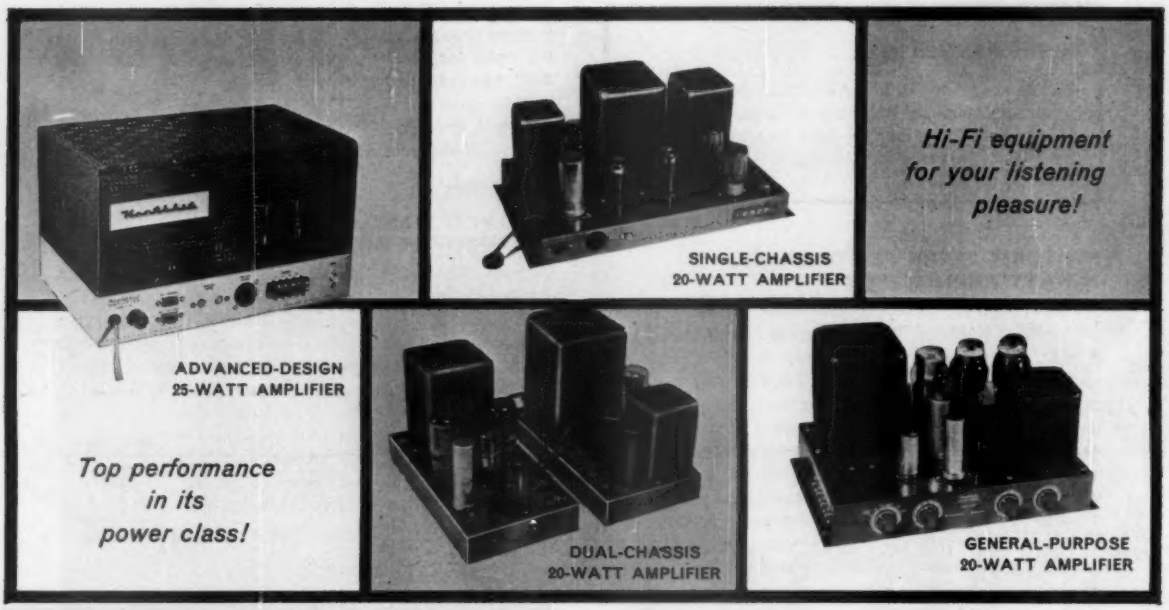
$19.75 (with cabinet)

NEW



HEATHKIT "BASIC RANGE" HI-FI SPEAKER SYSTEM KIT

HEATHKIT "LEGATO" HIGH FIDELITY SPEAKER SYSTEM KIT



HEATHKIT ADVANCED-DESIGN 25-WATT HIGH FIDELITY AMPLIFIER KIT

Designed especially to satisfy critical audio requirements, the W-5M incorporates the extra features needed to compliment the finest in program sources and speaker systems. Faithful sound reproduction is assured with a frequency response of ±1 db from 5 to 160,000 cps at 1 watt, and harmonic distortion is less than 1% at 25 watts, with IM distortion less than 1% at 20 watts. Hum and noise are a full 99 db below rated output, assuring quiet, hum-free operation. Output taps are 4, 8 and 16 ohms. Exclusive Heathkit features include the "tweeter saver", and the "bas-bal" balancing circuit, requiring only a voltmeter for indication. Years of reliable service are guaranteed through the use of conservatively rated, high quality components. KT66 tubes and Peerless output transformer are typical. Shipped express only. Shpg. Wt. 31 lbs.

MODEL W-5M

MODEL W-5: Consists of W-5M kit above plus model WA-P2 preamplifier. Express only. Shpg. Wt. 38 lbs. $79.50

$59.75

HEATHKIT DUAL-CHASSIS 20-WATT HIGH FIDELITY AMPLIFIER KIT

The model W3-AM is a Williamson-type amplifier built on two separate chassis. The power supply is on one chassis, and the amplifier stages are on the other chassis. Using two separate chassis provides additional flexibility in installation. Features include the famous acrosound model TO-300 "ultralinear" output transformer and 5881 tubes for broad frequency response, low distortion, and low hum level. The result is exceptionally fine overall tone quality. Frequency response is ±1 db from 6 cps to 150 kc at 1 watt. Harmonic distortion is less than 1% and IM distortion is less than 1.3% at 20 watts. Hum and noise are 88 db below 20 watts. Designed to match the speaker system of your choice, with taps for 4, 8 or 16 ohms impedance. A very popular high fidelity unit employing top quality components throughout. Shipped express only. Shpg. Wt. 29 lbs.

MODEL W-3AM

MODEL W-3A: Consists of W-3AM kit above plus model WA-P2 preamplifier. Express only. Shpg. Wt. 37 lbs. $69.50

$49.75

HEATHKIT SINGLE-CHASSIS 20-WATT HIGH FIDELITY AMPLIFIER KIT

The model W4-AM Williamson-type amplifier will amaze you with its outstanding performance. A true Williamson circuit, featuring extended frequency response, low distortion, and low hum levels, this amplifier can provide you with many hours of listening enjoyment with only a minimum investment compared to other units on the market. 5881 tubes and a special Chicago-standard output transformer are employed to give you full fidelity at minimum cost. Frequency response extending from 10 cps to 100 kc within ±1 db at 1 watt assures you of full coverage of the audio range, and clean clear sound amplification takes place in circuits that hold harmonic distortion at 1.5% and IM distortion below 2.7% at full 20 watt output. Hum and noise are 95 db below full output. Taps on the output transformer are at 4, 8 or 16 ohms. Shipped express only. Shpg. Wt. 28 lbs.

MODEL W4-AM

MODEL W-4A: Consists of W-4AM kit above, plus model WA-P2 preamplifier. Express only. Shpg. Wt. 35 lbs. $59.50.

$39.75

Heathkits...

By DAYSTROM

bring you the lasting satisfaction of personal accomplishment

HEATHKIT GENERAL-PURPOSE 20-WATT HIGH FIDELITY AMPLIFIER KIT

The model A-9C will provide you with high quality sound at low cost. Features a built-in preamplifier with four separate inputs, and individual volume, bass and treble controls. Frequency response covers 20 to 20,000 cps within ±1 db. Total harmonic distortion is less than 1% at 3 db below rated output. Push-pull 6L6 tubes are used, with output transformer tapped at 4, 8, 16 and 500 ohms. A true hi-fi unit using high-quality components throughout, including heavy-duty "potted" transformers. Shpg. Wt. 23 lbs.

MODEL A-9C

$35.50

±1 db from 10 cps to 250 kc. Precision type multiplier resistors used for high accuracy, and crystal diode bridge for wide-range frequency response. This meter is used in many-

HEATHKIT "BASIC RANGE" HI-FI SPEAKER SYSTEM KIT

The extremely popular Heathkit model SS-1 Speaker System provides amazing high fidelity performance for its size. Features two high-quality Jensen speakers, an 8" mid-range woofer and compression-type tweeter with flared horn. Covers from 50 to 12,000 CPS within ±5 db, in a special-design ducted-port, bass reflex enclosure. Impedance is 16 ohms. Cabinet measures 11½" H x 23" W x 11¾" D. Constructed of veneer-surfaced plywood, ½" thick, suitable for light or dark finish. All wood parts are precut and predrilled for easy, quick assembly. Shpg. Wt. 30 lbs.

MODEL SS-1
$39.95

HEATHKIT "RANGE EXTENDING" HI-FI SPEAKER SYSTEM KIT

Extends the range of the SS-1 to ±5 db from 35 to 16,000 CPS. Uses 15" woofer and super-tweeter both by Jensen. Kit includes crossover circuit. Impedance is 16 ohms and power rating is 35 watts. Measures 29" H x 23" W x 17½" D. Constructed of veneer-surfaced plywood ¾" thick. Easy to build! Shpg. Wt. 80 lbs.

MODEL SS-1B
$99.95

Heathkits...

By DAYSTROM

let you save up to ½ or more on all types of electronic equipment.

HEATHKIT SINE-SQUARE GENERATOR

The new AG-10 provides high quality, sine and square waves over a wide range, for countless applications. Some of these are; radio and TV repair work, checking scope performance, as a variable trigger source for telemetering and pulse work, and checking audio, video and hi-fi amplifier response. Frequency response is ±1.5 db from 20 CPS to 1 MC on both sine and square waves, with less than .25% sine wave distortion, 20 to 20,000 CPS. Sine wave output impedance 600 ohms, square wave output impedance 50 ohms, (except on 10v ranges). Square wave rise time less than .15 usec. Five-position band switch—continuously variable tuning—shielded oscillator circuit—separate step and variable output attenuators in ranges of 10, 1, and .1 volts for both sine and square wave, with extra range of .01 volt on sine wave. Both sine and square wave can be used at the same time without affecting either wave form. Power supply uses silicon-diode rectifiers. Shpg. Wt. 12 lbs.

MODEL AG-10
$49.95

HEATHKIT AUDIO ANALYZER KIT

The AA-1 is actually three instruments in one compact package. It combines the functions of an AC VTVM, an audio wattmeter, and an intermodulation analyzer. Input and output terminals are combined, and high and low frequency oscillators are built in. VTVM ranges are 0-.01, .03, .1, .3, 1, 3, 10, 30, 100 and 300 volts (RMS). Wattmeter ranges are .15 mw, 1.5 mw, 15 mw, 150 mw, 1.5 w, 15 w and 150 w. IM scales are 1%, 3%, 10%, 30% and 100%. Provides internal load resistors of 4, 8, 16 or 600 ohms. A tremendous dollar value. Shpg. Wt. 13 lbs.

MODEL AA-1
$49.95

HEATHKIT "LEGATO" HIGH FIDELITY SPEAKER SYSTEM KIT

The quality of the Legato, in terms of the engineering that went into the initial design, and in terms of the materials used in its construction, is matched in only the most expensive speaker systems available today. The listening experience it provides approaches the ultimate in esthetic satisfaction. Two 15" theater-type Altec Lansing speakers cover 25 to 500 CPS, and an Altec Lansing high-frequency driver with sectoral horn covers 500 to 20,000 CPS. A precise amount of phase shift in the crossover network brings the high frequency channel into phase with the low frequency channel to eliminate peaks or valleys at the crossover point, by equalizing the acoustical centers of the speakers. The enclosure is a modified infinite baffle type, especially designed for these speakers. Cabinet is constructed of veneer-surfaced plywood, ¾" thick, precut and predrilled for easy assembly. Frequency response 25 to 20,000 CPS. Power rating, 50 watts program material. Impedance is 16 ohms. Cabinet dimensions 41" L x 22¼" D x 34" H.

Choice of two beautiful cabinets. Model HH-1-C in imported white birch for light finishes, and HH-1-CM in African mahogany for dark finishes. Shpg. Wt. 195 lbs.

MODEL HH-1-C
MODEL HH-1-CM
$325.00 EACH

"BASIC RANGE" HI-FI SPEAKER SYSTEM
Superlative sound reproduction through the speaker system of your choice
"RANGE EXTENDING" HI-FI SPEAKER SYSTEM
"LEGATO" HI-FI SPEAKER SYSTEM
SINE-SQUARE GENERATOR
AUDIO ANALYZER
Sine and square waves for countless applications.

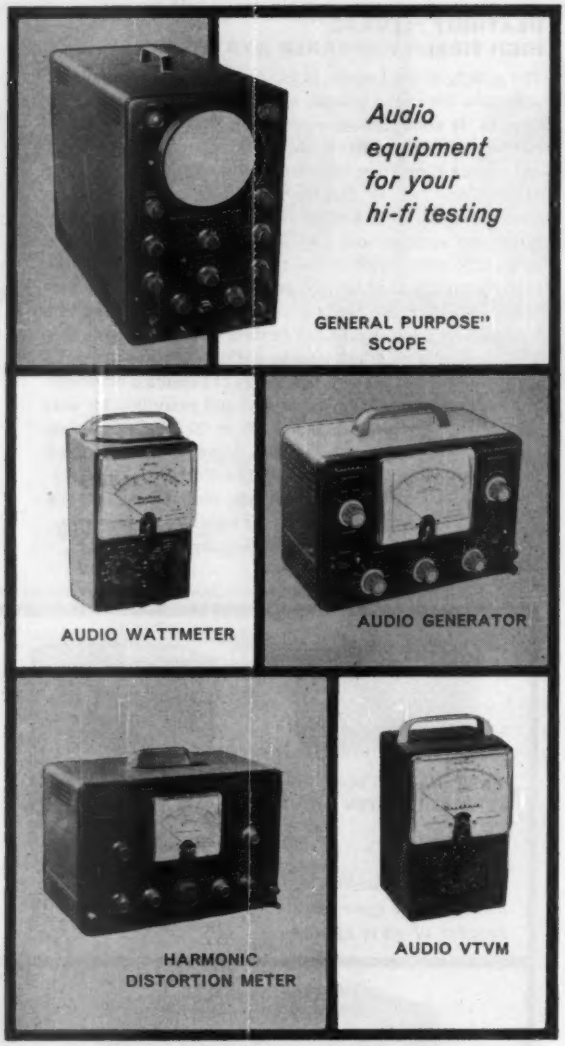
HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

HEATHKIT COLOR BAR AND DOT GENERATOR

The CD-1 combines the two basic color service instruments, a Color Bar Generator and White Dot Generator in

HEATHKIT "EXTRA DUTY" 5" OSCILLOSCOPE KIT

This fine oscilloscope compares favorably to other scopes



HEATHKIT "GENERAL PURPOSE" 5" OSCILLOSCOPE KIT

The model OM-2 Oscilloscope is especially popular with part-time service technicians, students, and high fidelity enthusiasts. It features good vertical frequency response ±3 db from 4 cps to over 1.2 mc. A full five-inch crt, and sweep generator operation from 20 cps to over 150 kc. Stability is excellent and calibrated grid screen allows precise signal observation. Extra features include external or internal sweep and sync, 1-volt peak-to-peak calibrating reference, 3-position step-attenuated input, adjustable spot shape control, push-pull horizontal and vertical amplifiers, and modern etched-metal circuits. Easy to build and a pleasure to use. Ideal for use with other audio equipment for checking amplifiers. Shpg. Wt. 21 lbs.

MODEL OM-2

$42.50

HEATHKIT AUDIO WATTMETER KIT

The AW-1 Audio Wattmeter can be used in any application where audio power output is to be measured. Non-inductive LOAD resistors are built in for 4, 8, 16 or 600 ohms impedance. Five power ranges cover 0-5 mw, 50 mw, 500 mw, 5 w, and 50 w full scale. Five switch-selected db ranges cover −10 db to +30 db. All indications are read directly on a large 4½" 200 microampere meter. Frequency response is ±1 db from 10 cps to 250 kc. Precision type multiplier resistors used for high accuracy, and crystal diode bridge for wide-range frequency response. This meter is used in many recording studios and broadcast stations as a monitor as well as servicing. A fine meter to help supply the answers to your audio operating or power output problems. Shpg. Wt. 6 lbs.

MODEL AW-1

$29.50

HEATHKIT AUDIO SIGNAL GENERATOR KIT

The model AG-9A is "made to order" for high fidelity applications, and provides quick and accurate selection of low-distortion signals throughout the audio range. Three rotary switches select two significant figures and a multiplier to determine audio frequency. Incorporates step-type and a continuously variable output attenuator. Output indicated on large 4½" panel meter, calibrated in volts and db. Attenuator system operates in 10 db steps, corresponding to meter calibration, in ranges of 0-.003, .01, .03, .1, .3, 1,3 and 10 volts RMS. "Load" switch permits use of built-in 600-ohm load, or external load of different impedance. Output and frequency indicators accurate to within ±5%. Distortion less than .1 of 1% between 20 and 20,000 cps. Total range is 10 cps to 100 kc. Shpg. Wt. 8 lbs.

MODEL AG-9A

$34.50

HEATHKIT HARMONIC DISTORTION METER KIT

All sounds consist of dominant tones plus harmonics (overtones). These harmonics enrich the quality and brightness of the music. However, additional harmonics which originate in the audio equipment, represent distortion. Used with an audio signal generator, the HD-1 will accurately measure this harmonic distortion at any or all frequencies between 20 and 20,000 cps. Distortion is read directly on the panel meter in ranges of 0-1, 3, 10, 30 and 100% full scale. Voltage ranges of 0-1, 3, 10 and 30 volts are provided for the initial reference settings. Signal-to-noise ratio measurements are also permitted through the use of a separate meter scale calibrated in db. High quality components insure years of outstanding performance. Full instructions are provided. Shpg. Wt. 13 lbs.

MODEL HD-1

$49.50

Heathkits...

By DAYSTROM

are well known for their high quality and reliability.

HEATHKIT AUDIO VTVM KIT

This new and improved AC Vacuum Tube Voltmeter is designed especially for audio measurements and low-level AC measurements in power supply filters, etc. Employs an entirely new circuit featuring a cascode amplifier with cathode-follower isolation between the input and the amplifier, and between the output stage and the preceding stages. It emphasizes stability, broad frequency response, and sensitivity. Frequency response is essentially flat from 10 cps to 200 kc. Input impedance is 1 megohm at 1000 cps. AC (RMS) voltage ranges are 0-.01, .03, .1, .3, 1, 3, 10, 30, 100 and 300 volts. Db ranges cover −52 db to +52 db. Features large 4½" 200 microampere meter, with increased damping in meter circuit for stability in low frequency tests. 1% precision resistors employed for maximum accuracy. Stable, reliable performance in all applications. Shpg. Wt. 5 lbs.

MODEL AV-3

$29.95

HEATHKIT TUBE CHECKER KIT

HEATHKIT ETCHED-CIRCUIT VTVM KIT

HEATHKIT COLOR BAR AND DOT GENERATOR

The CD-1 combines the two basic color service instruments, a Color Bar Generator and White Dot Generator in one versatile portable unit, which has crystal-controlled accuracy and stability (no external sync lead required). Produces white-dots, cross hatch, horizontal and vertical bars, 10 vertical color bars, and a new shading bar pattern for screen and background adjustments. Variable RF output on any channel from 2 to 6. Positive or negative video output, variable from 0 to 10 volts peak-to-peak. Crystal controlled sound carrier with off-on switch. Voltage regulated power supply using long-life silicon rectifiers. Gain knowledge of a new and profitable field by constructing this kit. Shpg. Wt. 12 lbs.

MODEL CD-1
$59.95

Heathkits...

By DAYSTROM

are guaranteed to meet or exceed advertised specifications

HEATHKIT TV ALIGNMENT GENERATOR KIT

This fine TV alignment generator offers stability and flexibility difficult to obtain even in instruments costing several times this low Heathkit price. It covers 3.6 mc to 220 mc in four bands. Sweep deviation is controllable from 0 to 42 mc. The all-electronic sweep circuit insures stability. Crystal marker and variable marker oscillators are built in. Crystal (included with kit) provides output at 4.5 mc and multiples thereof Variable marker provides output from 19 to 60 mc on fundamentals and from 57 to 180 mc on harmonics. Effective two-way blanking to eliminate return trace. Phasing control. Kit is complete, including three output cables. Shpg. Wt. 16 lbs.

MODEL TS-4A
$49.50

HEATHKIT "EXTRA DUTY" 5" OSCILLOSCOPE KIT

This fine oscilloscope compares favorably to other scopes costing twice its price. It contains the extra performance so necessary for monochrome and color-TV servicing. Features push-pull horizontal and vertical output amplifiers, a 5UP1 CRT, built in peak-to-peak calibration source, a fully compensated 3-position step-type input attenuator, retrace blanking, phasing control, and provision for Z-axis modulation. Vertical amplifier frequency response is within +1.5 and −5 db from 3 CPS to 5 MC. Response at 3.58 MC down only 2.2 db. Sensitivity is 0.025 volts RMS/inch at 1 kc. Sweep generator covers 20 CPS to 500 kc in five steps, five times the usual sweep obtained in other scopes through the use of the patented Heath sweep circuit. Etched-metal circuit boards reduce assembly time and minimize errors in assembly, and more importantly, permit a level of circuit stability never before achieved in an oscilloscope of this type. Shpg. Wt. 21 lbs.

MODEL O-11
$69.50

HEATHKIT ELECTRONIC SWITCH KIT

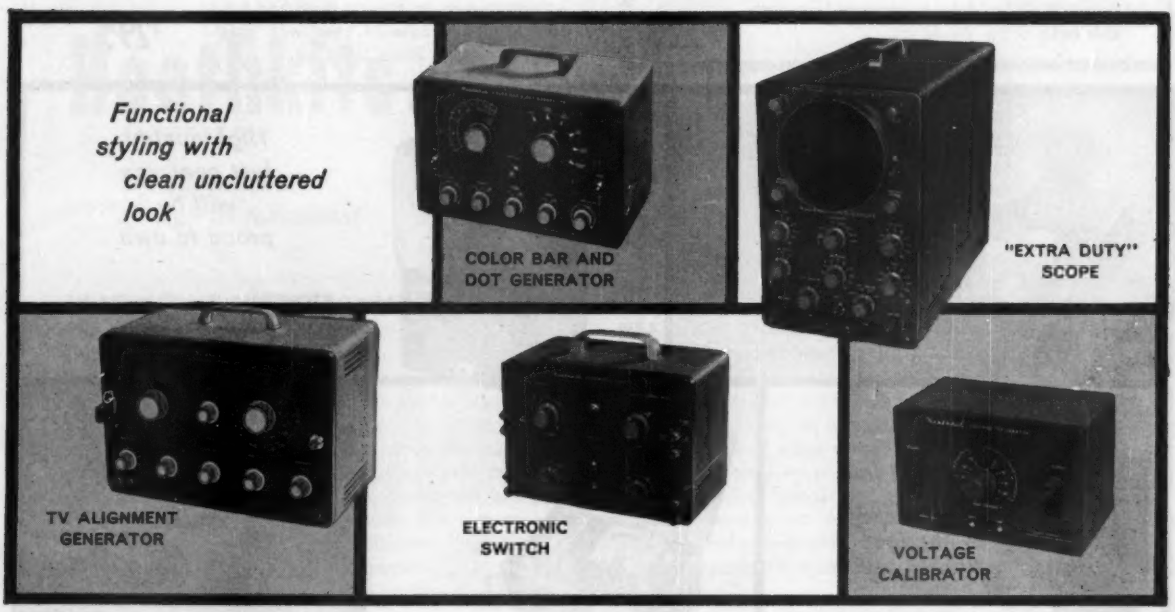
A valuable accessory for any oscilloscope owner. It allows simultaneous oscilloscope observation of two signals by producing both signals, alternately at its output. Four switching rates. Provides gain for input signals. Frequency response ±1 db, 0 to 100 kc. A sync output is provided to control and stabilize scope sweep. Ideal for observing input and output of amplifiers simultaneously. Shpg. Wt. 8 lbs.

MODEL S-3
$21.95

HEATHKIT VOLTAGE CALIBRATOR KIT

This unit is an excellent companion for your oscilloscope. Used as a source of calibrating voltage, it produces near-perfect square wave signals of known amplitude. Precision 1% attenuator resistors insure accurate output amplitude, and multivibrator circuit guarantees good sharp square waves. Output frequency is approximately 1000 CPS. Fixed outputs selected by panel switches are; .03, 0.1, 0.3, 1.0, 3.0, 10, 30 and 100 volts peak-to-peak. Allows measurement of unknown signal amplitude by comparing it to the known output of the VC-3 on oscilloscope. Shpg. Wt. 4 lbs.

MODEL VC-3
$12.50



HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

HEATHKIT RF SIGNAL GENERATOR KIT

Even a beginner can build this prealigned signal generator, designed especially for use in service work. Produces RF

HEATHKIT TUBE CHECKER KIT

Eliminate guesswork, and save time in servicing or experimenting. The TC-2 tests tubes for shorted elements, open elements, filament continuity, and operating quality on the basis of total emission. It tests all tube types encountered in radio and TV service work. Sockets are provided for 4, 5, 6 and 7-pin, octal, and loctal tubes, 7 and 9 pin miniature tubes, 5 pin hytron miniatures, and pilot lamps. Tube condition indicated on 4½" meter with multicolor "good-bad" scale. Illuminated roll chart with all test data built in. Switch selection of 14 different filament voltages from .75 to 117 volts. Color-coded cable harness allows neat professional wiring and simplifies construction. Very easy to build, even for a beginner. Shpg. Wt. 12 lbs.

MODEL TC-2

$29.50

HEATHKIT HANDITESTER KIT

The small size and rugged construction of this tester makes it perfect for any portable application. The combination function-range switch simplifies operations. Measures AC or DC voltage at 0-10, 30, 300, 1000 and 5000 volts. Direct current ranges are 0-10 ma and 0-100 ma. Ohmmeter ranges are 0-3000 (30 ohm center scale) and 0-300,000 (3000 ohm center scale). Very popular with home experimenters, electricians, and appliance repairmen. Slips easily into your tool box, glove compartment, coat pocket, or desk drawer. Shpg. Wt. 3 lbs.

MODEL M-1

$14.50

HEATHKIT PICTURE TUBE CHECKER KIT

The CC-1 can be taken with you on service calls so that you can clearly demonstrate the quality of a customer's picture tube in his own home. Tubes can be tested without removing them from the receiver or cartons if desired. Checks cathode emission, beam current, shorted elements, and leakage between elements in electromagnetic picture tube types. Self-contained power supply, and large 4½" meter. CRT condition indicated on "good-bad" scale. Relative condition of tubes fluorescent coating is shown in "shadowgraph" test. Permanent test cable with CRT socket and anode connector. No tubes to burn out, designed to last a lifetime. Luggage-type portable case. Shpg. Wt. 10 lbs.

MODEL CC-1

$22.50

HEATHKIT ETCHED-CIRCUIT VTVM KIT

This multi-purpose VTVM is the world's largest selling instrument of its type—and is especially popular in laboratories, service shops, home workshops and schools. It employs a large 4½" panel meter, precision 1% resistors, etched metal circuit board, and many other "extras" to insure top quality and top performance. It's easy to build, and you may rely on its accuracy and dependability. The V7-A will measure AC (RMS) and DC voltages in ranges of 0-1.5, 5, 15, 50, 150, 500 and 1500. It measures peak-to-peak AC voltage in ranges of 0-4, 14, 40, 140, 400, 1400 and 4000. Resistance ranges provide multiplying factors of X 1, X 10, X 100, X 1000, X 10k, X 100k, and X 1 megohm. Center-scale resistance readings are 10, 100, 1000, 10k, 100k, 1 megohm and 10 megohms. A db scale is also provided. The precision and quality of this VTVM cannot be duplicated at this price. Shpg. Wt. 7 lbs.

MODEL V7-A

$24.50

Heathkits...

By DAYSTROM

let you fill your exact needs from a wide variety of instruments

HEATHKIT 20,000 OHMS/VOLT VOM KIT

This fine instrument provides a total of 25 meter ranges on its two-color scale. It employes a 50 ua 4½" meter, and features 1% precision multiplier resistors. Requires no external power. Ideal for portable applications. Sensitivity is 20,000 ohms-per-volt DC and 5000 ohms-per-volt AC. Measuring ranges are 0-1.5, 5, 50, 150, 500, 1500 and 5000 volts, AC and DC. Measures direct current in ranges of 0-150 ua, 15 ma, 150 ma, 500 ma and 15 a. Resistance multipliers are X 1, X 100 and X 10,000, with center-scale readings of 15, 1500 and 150,000 ohms. Covers −10 db to +65 db. Easy to build and fun to use. Attractive bakelite case with plastic carrying handle. Shpg. Wt. 6 lbs.

MODEL MM-1

$29.50

TUBE CHECKER
High quality test gear you will be proud to own
ETCHED CIRCUIT VTVM
Priced low to fit your budget
HANDITESTER
PICTURE TUBE CHECKER
20,000 OHMS/VOLT VOM

HEATHKIT RF SIGNAL GENERATOR KIT

Even a beginner can build this prealigned signal generator, designed especially for use in service work. Produces RF signals from 160 kc to 110 mc on fundamentals in five bands. Covers 110 mc to 220 mc on calibrated harmonics. Low impedance RF output in excess of 100,000 microvolts, is controllable with a step-type and continuously variable attenuator. Selection of unmodulated RF, modulated RF, or audio at 400 CPS. Ideal for fast and easy alignment of radio receivers, and finds application in FM and TV work as well. Thousands of these units are in use in service shops all over the country. Easy to build and a real time saver, even for the part-time service technician or hobbyist. Shpg. Wt. 8 lbs.

MODEL SG-8

$19.50

HEATHKIT LABORATORY RF GENERATOR KIT

Tackle all kinds of laboratory alignment jobs with confidence by employing the LG-1. It features voltage-regulated B+, double shielding of oscillator circuits, copper-plated chassis, variable modulation level, metered output, and many other "extras" for critical alignment work. Generates RF signals from 100 kc to 30 mc on fundamentals in five bands. Meter reads RF output in microvolts or modulation level in percentage. RF output available up to 100,000 microvolts, controlled by a fixed-step and a variable attenuator. Provision for external modulation where necessary. Buy and use this high-quality RF signal generator that may be depended upon for stability and accuracy. Shpg. Wt. 16 lbs.

MODEL LG-1

$48.95

HEATHKIT DIRECT-READING CAPACITY METER KIT

Here's a fast, simple capacity meter. A capacitor to be checked is merely connected to the terminals, the proper range selected, and the value read directly on the large 4½" panel meter calibrated in mmf and mfd. Ranges are 0 to 100 mmf, 1,000 mmf, .01 mfd, .1 mfd full scale. Not affected by hand capacity. Shpg. Wt. 7 lbs.

MODEL CM-1

$29.50

Heathkits...

By DAYSTROM

are educational as well as functional

HEATHKIT CONDENSER CHECKER KIT

This handy instrument uses an electron beam "eye" tube as an indicator to measure capacity in ranges of .00001 to .005 mfd, .5 mfd, 50 mfd and 1000 mfd. Also measures resistance from 100 ohms to 5 megohms in two ranges. Checks paper, mica, ceramic and electrolytic capacitors. Selection of five polarizing voltages. Shpg. Wt. 7 lbs.

MODEL C-3

$19.50

HEATHKIT "IN-CIRCUIT" CAPACI-TESTER KIT

With the CT-1 it is no longer necessary to disconnect one capacitor lead to check the part, you can check most capacitors for "open" or "short" right in the circuit. Fast and easy—to save your valuable time in the service shop or lab. Detects open capacitors from about 50 mmf up, so long as the capacitor is not shunted by excessively low resistance value. Will detect shorted capacitors up to 20 mfd (not shunted by less than 10 ohms). (Does not detect leakage.) Employs 60 cycles and 19 megacycle test frequencies. Electron beam "eye" tube used as indicator. Compact, easy-to-build, and inexpensive. Test leads included. Shpg. Wt. 5 lbs.

MODEL CT-1

$7.95

HEATHKIT VISUAL-AURAL SIGNAL TRACER KIT

Although designed originally for radio receiver work, the T-3 finds application in FM and TV servicing as well. Features high-gain channel with demodulator probe, and low-gain channel with audio probe. Traces signals in all sections of radio receivers and in many sections of FM and TV receivers. Built-in speaker and electron beam eye tube indicate relative gain, etc. Also features built-in noise locator circuit. Provision for patching speaker and /or output transformer to external set. Shpg. Wt. 9 lbs.

MODEL T-3

$23.50

HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

HEATHKIT IMPEDANCE BRIDGE KIT

The model IB-2A employs a Wheatstone Bridge, a Capacity Comparison Bridge, a Maxwell Bridge, and a Hay Bridge in one compact package. Measures resistance from 0.1 ohm to 10 megohms, capacitance from 100 mmf to 100 mfd, inductance from 0.1 mh to 100 h, dissipation factor (D) from 0.002 to 1, and storage factor (Q) from 0.1 to 1000. A 100-0-100 ua meter provides for null indications. The decade resistors employed are of 1% tolerance for maximum accuracy. Completely self-contained. Has built in power supply, 1000-cycle generator, and vacuum-tube detector. Special two-section CRL dial insures convenient operation. Instruction manual has entirely new schematic that clarifies circuit functions in various switch positions. A true laboratory instrument, that will provide you with many years of fine performance. Shpg. Wt. 12 lbs.

MODEL IB-2A

$59.50

HEATHKIT "LOW RIPPLE" BATTERY ELIMINATOR KIT

This modern battery eliminator incorporates an extra low-ripple filter circuit so that it can be used to power all the newest transistor-type circuits requiring 0 to 12 volts DC, and the new "hybrid" automobile radios using both transistors and vacuum tubes. Its DC output, at either 6 or 12 volts, contains less than .3% AC ripple. Separate output terminals are provided for low-ripple or normal filtering. Supplies up to 15 amps on 6 volt range or up to 7 amps on 12 volt range. Output is variable from 0 to 8 or 0 to 16 volts. Two meters constantly monitor output voltage and current. Will also double as a battery charger. Shpg. Wt. 23 lbs.

MODEL BE-5

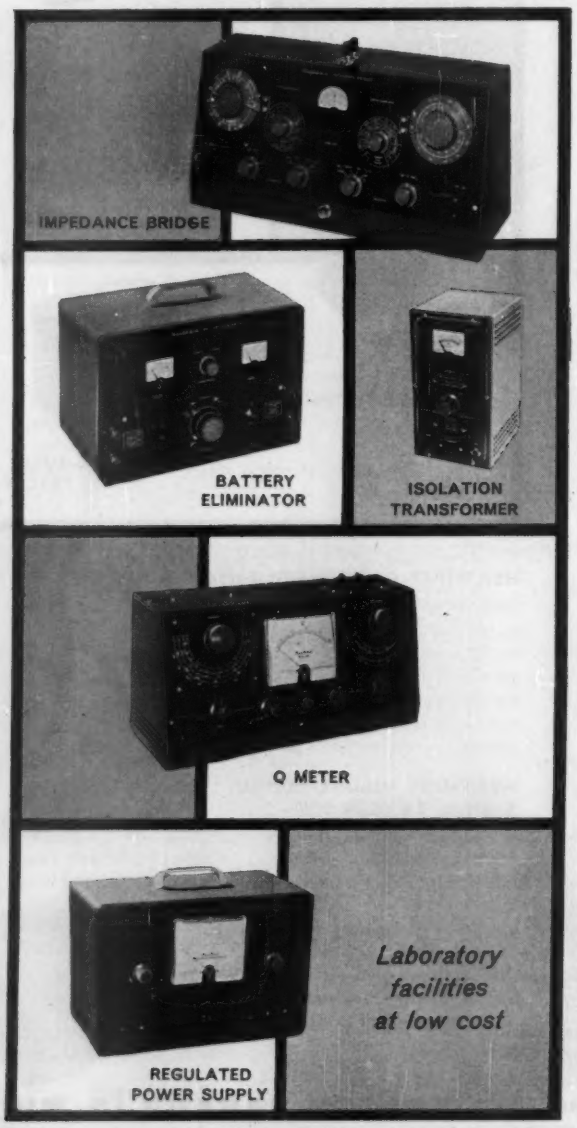
$39.95

HEATHKIT ISOLATION TRANSFORMER KIT

The model IT-1 is one of the handiest units for the service shop, home workshop or laboratory. Provides complete isolation from the power line. AC-DC sets may be plugged directly into the IT-1 without the chassis becoming "hot". Output voltage is variable from 90 volts to 130 volts allowing checks of equipment under adverse conditions such as low line voltage. Rated for 100 volt amperes continuously or 200 volt amperes intermittently. Panel meter monitors output voltage. Shpg. Wt. 9 lbs.

MODEL IT-1

$16.50



Heathkits...

By DAYSTROM

are designed with high-quality, name-brand components to insure long service life

HEATHKIT "Q" METER KIT

At this price the laboratory facilities of a Q Meter may be had by the average service technician or home experimenter. The Q Meter permits measurement of inductance from 1 microhenry to 10 millihenry, "Q" on a scale calibrated up to 250 full scale, with multipliers of 1 or 2, and capacitance from 40 mmf to 450 mmf ± 3 mmf. Built in oscillator permits testing components from 150 kc to 18 mc. Large 4½" panel meter is featured. Very handy for checking peaking coils, chokes, etc. Use to determine values of unknown condensers, both variable and fixed, compile data for coil winding purposes, or measure RF resistance. Also checks distributed capacity and Q of coils. No special equipment is required for calibration. A special test coil is furnished, along with easy-to-follow instructions. Shpg. Wt. 14 lbs.

MODEL QM-1

$44.50

HEATHKIT REGULATED POWER SUPPLY KIT

Here is a power supply that will provide DC plate voltage and AC filament voltage for all kinds of experimental circuits. The DC supply is regulated for stability, and yet the amount of DC output voltage available from the power supply can be controlled manually from 0 up to 500 volts. At 450 volts DC output, the power supply will provide up to 10 ma of current, and provide progressively higher current as the output voltage is lowered. Current rating is 130 ma at 200 volts output. In addition to furnishing B+ the power supply also provides 6.3 volts AC at up to 4 amperes for filaments. Both the B+ output and the filament output are isolated from ground. Ideal unit for use in laboratory, home workshop, ham shack, or service shop. A large 4½" meter on the front panel reads output voltage or output current, selectable with a panel switch. Shpg. Wt. 17 lbs.

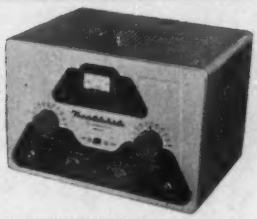
MODEL PS-3

$35.50

Terrific values in amateur equipment!

DX-100 TRANSMITTER

DX-20 TRANSMITTER



DX-35 TRANSMITTER

HEATHKIT DX-20 CW TRANSMITTER KIT

The Heathkit model DX-20 "straight-CW" transmitter features high efficiency at low cost. It uses a single 6DQ6A tube in the final amplifier stage for plate power input of 50 watts. A 6CL6 serves as crystal oscillator, with a 5U4GB rectifier. It is an ideal transmitter for the novice, as well as the advanced-class CW operator. Single-knob band switching is featured to cover 80, 40, 20, 15, 11 and 10 meters. Pi network output circuit matches various antenna impedances between 50 and 1000 ohms and reduces harmonic output. Top-quality parts are featured throughout, including "potted" transformers, etc., for long life. It has been given full "TVI" treatment. Access into the cabinet for crystal changing is provided by a removable metal pull-out plug on the left end of the cabinet. Very easy to build from the complete step-by-step instructions supplied, even if you have never built electronic equipment before. If you appreciate a good, clean signal on the CW bands, this is the transmitter for you! Shpg. Wt. 18 lbs.

MODEL DX-20

$35.95

Heathkits...

By DAYSTROM

are designed by licensed ham-engineers, especially for you

HEATHKIT DX-35 PHONE AND CW TRANSMITTER KIT

The DX-35 transmitter can be thought of as the "little brother" of the DX-100. It features both phone and CW operation on 80, 40, 20, 15, 11 and 10 meters. A single 6146 tube is used in the final amplifier stage to provide full 65 watt plate power input on CW, or controlled carrier modulation peaks up to 50 watts for phone operation. Modulator and power supplies are built right in and single knob band switching is combined with a pi network output circuit for complete operating convenience. The tight fitting cabinet presents a most attractive appearance, and is designed for complete shielding to minimize TVI. Back panel control provides convenient switch selection of three different crystals, reached through access door at rear of cabinet. A most remarkable power package for the price. Complete step-by-step instructions with pictorial diagrams to assure your success in assembly. Shpg. Wt. 24 lbs.

MODEL DX-35

$56.95

HEATHKIT DX-100 PHONE AND CW TRANSMITTER KIT

Listen to any ham band between 160 meters and 10 meters and note how many DX-100 transmitters you hear! The number of these fine rigs now on the air testifies to the enthusiasm with which it has been accepted by the amateur fraternity. No other transmitter in this power class combines high quality and real economy so effectively. The DX-100 features a built in VFO, modulator and power supplies, complete shielding to minimize TVI, and pi network output coupling to match impedances from approximately 50 to 600 ohms. Its RF output is in excess of 100 watts on phone and 120 watts on CW, for a clean strong signal on all the ham bands from 10 to 160 meters. Single-knob band switching and illuminated VFO dial and meter face add real operating convenience. RF output stage uses a pair of 6146 tubes in parallel, modulated by a pair of 1625's. High quality components are used throughout, such as "potted" transformers, silver-plated or solid coin silver switch terminals, aluminum heat-dissipating caps on the final tubes, copper plated chassis, etc. This transmitter was designed exclusively for easy step-by-step assembly. Shpg. Wt. 107 lbs.

MODEL DX-100

$189.50

FUNCTIONAL DESIGN . . .

The transmitters described on this page were designed for the ham, by hams who know what features are desirable and needed. This assures you of the best possible performance and convenience, and adds much to your enjoyment in the ham shack.

HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

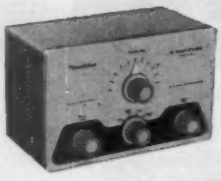
HEATHKIT REFLECTED POWER METER KIT

HEATHKIT VARIABLE FREQUENCY OSCILLATOR KIT

Automatically turns off transmitter and gives visual signal

"AUTOMATIC" CONELRAD ALARM

GRID DIP METER



"Q" MULTIPLIER

COMMUNICATIONS-TYPE RECEIVER

An ideal receiver for the beginning ham or short wave listener

HEATHKIT "AUTOMATIC" CONELRAD ALARM KIT

This conelrad alarm works with any radio receiver; AC-DC-transformer operated—or battery powered, so long as the receiver has AVC. Fully complies with FCC regulations for amateurs. When the monitored station goes off the air, the CA-1 automatically cuts the AC power to your transmitter, and lights a red indicator. A manual "reset" button reactivates the transmitter. Incorporates a heavy-duty six-ampere relay, a thyratron tube to activate the relay, and its own built-in power supply. A neon lamp shows that the alarm is working, by indicating the presence of B+ in the alarm circuit. Simple to install and connect. Your transmitter plugs into an AC receptacle on the CA-1, and a cable connects to the AVC circuit of a nearby receiver. A built-in sensitivity control allows adjustment to various AVC levels. Receiver volume control can be turned up or down, without affecting alarm operation. Build a Heathkit CA-1 in one evening and comply with FCC regulations now! Shpg. Wt. 4 lbs.

MODEL CA-1
$13.95

HEATHKIT "Q" MULTIPLIER KIT

The Heathkit Q Multiplier functions with any AM receiver having an IF frequency between 450 and 460 KC, that is not "AC-DC" type. It derives its power from the receiver, and needs only 6.3 volts AC at 300 ma (or 12 VAC at 150 ma) and 150 to 250 volts DC at 2 ma. Simple to connect with cable and plugs supplied. Adds additional selectivity for separating signals, or will reject one signal and eliminate heterodyne. A tremendous help on crowded phone and CW bands. Effective Q of 4000 for sharp "peak" or "null". Tunes any signal within IF band pass without changing the main receiver tuning dial. A convenient tuning knob on the front panel with vernier reduction between the tuning knob and the tuning capacitor gives added flexibility in operation. Uses a 12AX7 tube, and special high-Q shielded coils. Instructions for connecting to the receiver and operation are provided in the construction manual. A worthwhile addition to any communications, or broadcast receiver. It may also be used with a receiver which already has a crystal filter to obtain two simultaneous functions, such as peaking the desired signal with the crystal filter and nulling an adjacent signal with the Q Multiplier. Shpg. Wt. 3 lbs.

MODEL QF-1
$9.95

HEATHKIT GRID DIP METER KIT

A grid dip meter is basically an RF oscillator for determining the frequency of other oscillators, or of tuned circuits. Extremely useful in locating parasitics, neutralizing, identifying harmonics, coil winding, etc. Features continuous frequency coverage from 2 mc to 250 mc, with a complete set of prewound coils, and a 500 ua panel meter. Front panel has a sensitivity control for the meter, and a phone jack for listening to the "zero-beat." Will also double as an absorption-type wave meter. Shpg. Wt. 4 lbs.

MODEL GD-1B
$19.95

Low Frequency Coil Kit: Two extra plug-in coils to extend frequency coverage down to 350 kc. Shpg. Wt. 1 lb. No. 341-A. $3.00

HEATHKIT ALL-BAND COMMUNICATIONS-TYPE RECEIVER KIT

This communications-receiver covers 550 kc to 30 mc in four bands, and provides good sensitivity, selectivity, and fine image rejection. Ham bands are clearly marked on an illuminated dial scale. Features a transformer-type power supply—electrical band spread—antenna trimmer—headphone jack—automatic gain control and beat frequency oscillator. Accessory sockets are provided on the rear of the chassis for using the Heathkit model QF-1, Q Multiplier. Accessory socket is handy, also, for operating other devices that require plate and filament potentials. Will supply +250 VDC at 15 ma and 12.6 VAC at 300 ma. Ideal for the beginning ham or short wave listener. Shpg. Wt. 12 lbs.

MODEL AR-3
$29.95
(Less cabinet)

Cabinet: Fabric covered cabinet with aluminum panel as shown. Part no. 91-15A. Shpg. Wt. 5 lbs. $4.95.

Heathkits...

By DAYSTROM

are outstanding in performance and dollar value

HEATHKIT ELECTRONIC

HEATHKIT PROFESSIONAL

HEATHKIT REFLECTED POWER METER KIT

The Heathkit reflected power meter, model AM-2, makes an excellent instrument for checking the match of the antenna transmission system, by measuring the forward and reflected power or standing wave ratio. The AM-2 is designed to handle a peak power of well over 1 kilowatt of energy and may be left in the antenna system feed line at all times. Band coverage is 160 meters through 2 meters. Input and output impedances for 50 or 75 ohm lines. No external power required for operation. Meter indicates percentage forward and reflected power, and standing wave ratio from 1:1 to 6:1. Another application for the AM-2 is matching impedances between exciters or R.F. sources and grounded grid amplifiers. Power losses between transmitter output and antenna tuner may be very easily computed by inserting the AM-2 in the line connecting the two. No insertion loss is introduced into the feeder system, due to the fact that the AM-2 is a portion of coaxial line in series with the feeder system and no internal connections are actually made to the line. Complete circuit description and operation instructions are provided in the manual. Cabinet size is 7-3/8" x 4-1/16" x 4-5/8". Can be conveniently located at operating position. Shpg. Wt. 3 lbs.

MODEL AM-2

$15.95

HEATHKIT VARIABLE FREQUENCY OSCILLATOR KIT

Enjoy the convenience and flexibility of VFO operation by obtaining the Heathkit model VF-1 Variable Frequency Oscillator. Covers 160-80-40-20-15-11 and 10 meters with three basic oscillator frequencies. Better than 10 volt average RF output on fundamentals. Plenty of output to drive most modern transmitters. It features voltage regulation for frequency stability. Dial is illuminated for easy reading. Vernier reduction is used between the main tuning knob and the tuning condenser. Requires a power source of only 250 volts DC at 15 to 20 miliamperes and 6.3 volts AC at 0.45 amperes. Extra features include copper-plated chassis, ceramic coil forms, extensive shielding, etc. High quality parts throughout. VFO operation allows you to move out from under interference and select a portion of the band you want to use without having to be tied down to only two or three frequencies through use of crystals. "Zero in" on the other fellow's signal and return his CQ on his own frequency! Crystals are not cheap, and it takes quite a number of them to give anything even approaching comprehensive coverage of all bands. Why hesitate? The model VF-1 with its low price and high quality will add more operating enjoyment to your ham activities. Shpg. Wt. 7 lbs.

MODEL VF-1

$19.50

Heathkits...

By DAYSTROM

are the answer for your electronics hobby.

HEATHKIT BALUN COIL KIT

The Heathkit Balun Coil Kit model B-1 is a convenient transmitter accessory, which has the capability of matching unbalanced coax lines, used on most modern transmitters, to balance lines of either 75 or 300 ohms impedance. Design of the bifilar wound balun coils will enable transmitters with unbalanced output to operate into balanced transmission line, such as used with dipoles, folded dipoles, or any balanced antenna system. The balun coil set can be used with transmitters and receivers without adjustment over the frequency range of 80 through 10 meters, and will easily handle power inputs up to 250 watts. Cabinet size is 9" square by 5" deep and it may be located any distance from the transmitter or from the antenna. Completely enclosed for outdoor installation. Shpg. Wt. 4 lbs.

MODEL B-1

$8.95

HEATHKIT 6 OR 12 VOLT VIBRATOR POWER SUPPLY KITS

These little power supply kits are ideal for all portable applications with 6 volt or 12 volt batteries, when you are operating electronic equipment away from power lines. By replacing the power supplies of receivers, small public address systems, or even miniature transmitters with these units, they can be used with conventional 6 or 12 volt batteries. Use in boats, automobiles, light aircraft, or any field application. Each unit provides 260 volts DC output at up to 60 miliamperes. More than one power supply of the same model may be connected in parallel for increased current capacity at the same output voltage. Everything is provided in the kit, including a vibrator transformer, a vibrator, 6X4 or 12X4 rectifier, and the necessary buffer capacitor, hash filter, and output filter capacitor. Shpg. Wt. 4 lbs.

6 VOLT MODEL VP-1-6
12 VOLT MODEL VP-1-12

$7.95 Each

REFLECTED POWER METER
Insure your "on the air" performance with these fine accessories.
VARIABLE FREQUENCY OSCILLATOR
VIBRATOR POWER SUPPLY
BALUN COIL SET

HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

HEATHKIT ELECTRONIC IGNITION ANALYZER KIT

Previous electronic experience is not necessary to build this fine ignition analyzer. The construction manual supplied has complete step-by-step instructions plus large pictorial diagrams showing the exact placement and value of each component. All parts are clearly marked so that they are easily identified. The IA-1 is an ideal tool for engine mechanics, tune-up men, and auto hobbyists, since it traces the dynamic action of voltage in an ignition system on a cathode-ray tube screen. The wave form produced is affected by the condition of the coil, condenser, points, plugs, and ignition wiring, so it can be analyzed and used as a "sign-post" to ignition system performance. This analyzer will detect inequality of spark intensity, a poor spark plug, defective plug wiring, breaker-point bounce, an open condenser, and allow setting of dwell-time percentage for the points. An important feature of this instrument is its ability to check dynamic performance, with the engine in operation (400 to 5000 RPM). It will show the complete engine cycle, or only one complete cylinder. Can be used on all types of internal combustion engines where breaker-points are accessible. Use it on automobiles, boats, aircraft engines, etc. Shpg. Wt. 18 lbs.

MODEL IA-1
$59.95

HEATHKIT PROFESSIONAL RADIATION COUNTER KIT

This Heathkit professional-type radiation counter is simple to build successfully, even if you have never built a kit before. Complete step-by-step instructions are combined with giant-size pictorial diagrams for easy assembly. By "building it yourself" you can have a modern-design, professional radiation counter priced far below comparable units. Provides high sensitivity with ranges from 0-100, 600, 6000 and 60,000 counts-per-minute, and 0-.02, .1, 1 and 10 miliroentgens-per-hour. Employs 900-volt bismuth tube in beta/gamma sensitive probe. Probe and 8-foot expandable cable included in kit price, as is a radiation sample for calibration. Use it in medical laboratories, or as a prospecting tool, and for civil defense to detect radioactive fallout, or other unknown radiation levels. Features a selectable time constant. Meter calibrated in CPM or mR/hour in addition to "beep" or "click" from panel-mounted speaker. Prebuilt "packaged" high voltage power supply with reserve capacity above 900 volt level at which it is regulated. Merely changing regulator tube type would allow use of scintillation probe if desired. Employs five tubes (plus a transistor) to insure stable and reliable operation. Kit price includes batteries. Shpg. Wt. 8 lbs.

MODEL RC-1
$79.95

Kit includes everything you need for construction — even batteries!

Heathkits...

By DAYSTROM

are supplied with comprehensive instructions that eliminate costly mistakes and save valuable time

HEATHKIT ENLARGER TIMER KIT

The ET-1 is an easy-to-build electronic device to be used by amateur or professional photographers in timing enlarger operations. The calibrated dial on the timer covers 0 to 1 minute, calibrated in 5-second gradations. The continuously variable control allows setting of the "on" cycle of your enlarger, which is plugged into a receptacle on the front panel of the ET-1. A "safe light" can also be plugged in so that it is automatically turned "on" when the enlarger is turned "off." Handles up to 350 watts with built-in relay. All-electronic timing cycle insures maximum accuracy. Timer does not have to be reset after each cycle, merely flip lever switch to print, to repeat time cycle. A control is provided for initial calibration. Housed in a compact plastic case that will resist attack of photographic chemicals. A fine addition to any dark room. Shpg. Wt. 3 lbs.

MODEL ET-1
$11.50

HEATHKIT BATTERY TESTER KIT

The BT-1 is a special battery testing device that actually "loads" the battery under test (draws current from it) while it is being tested. Weak batteries often test "good" with an ordinary voltmeter but the built-in load resistance of the BT-1 automatically draws enough current from the battery to reveal its true condition. Simple to operate with "good-weak-replace" scale. Tests all kinds of dry cell batteries within ranges of 0-15 volts and 0-180 volts. Slide switch provides for either 10 ma or 100 ma load, depending on whether you're testing an A or B battery. Not only determines when battery is completely exhausted, but makes it possible to anticipate failure by noting weak condition. Ideal for testing dry cell hearing aid, flashlight, portable radio, and model airplane batteries. Test batteries in a way your customers can understand and stimulate battery sales. Shpg. Wt. 2 lbs.

MODEL BT-1
$8.50

CRYSTAL RADIO
Now you can have radio wherever you go — with the portable that plays anywhere!
BROADCAST BAND RADIO
TRANSISTOR PORTABLE

HEATHKIT CRYSTAL RADIO KIT

The Heathkit model CR-1 crystal radio is similar to the "crystal sets" of the early radio days except that it has been improved by the use of sealed germanium diodes and efficient "high-Q" coils. The sealed diodes eliminate the critical "cats whisker" adjustment, and the ferrite coils are much more efficient for greater signal strength. Housed in a compact plastic box, the CR-1 uses two tuned circuits, each with a variable tuning capacitor, to select the local station. It covers the broadcast band from 540 to 1600 kc. Requires no external power whatsoever. This receiver could prove valuable to emergency reception of civil defense signals should there be a power failure. The low kit price even includes headphones. Complete step-by-step instructions and large pictorial diagrams are supplied for easy assembly. The instruction manual also provides the builder with the basic fundamentals of signal reception so that he understands how the crystal receiver functions. An interesting and valuable "do-it-yourself" project for all ages. Shpg. Wt. 3 lbs.

MODEL CR-1
$7.95

Heathkits...

By DAYSTROM

are easy and fun to build, and they let you learn by "doing-it-yourself"

HEATHKIT TRANSISTOR PORTABLE RADIO KIT

Heath engineers set out to develop a "universal" AM radio, suitable for use anywhere. Their objective was a portable that would be as much "at home" inside as it is outside, and would feature top quality components for high performance and long service life. The model XR-1 is the result of these efforts. Six name-brand (Texas Instrument) transistors were selected for extra good sensitivity and selectivity. A 4" by 6" PM speaker with heavy magnet was chosen to insure fine tone quality. The power supply was designed to use six standard size "D" flashlight cells because they are readily available, inexpensive, and because they afford extremely long battery life (between 500 and 1000 hours). Costs you no more to operate from batteries than what you pay for operating a small table-model radio from the power line. An unbreakable molded plastic was selected for cabinet material because of its durability and striking beauty. Circuit is compact and efficient, yet components are not excessively crowded. Transformers are prealigned so it is ready for service as soon as construction is completed. Has built in rod-type antenna for reception in all locations. Cabinet dimensions are 9" L x 8" H x 3¼" D. Comes in holiday gray, with gold-anodized metal speaker grille. Compare this portable, feature by feature, to all others on the market, and you'll appreciate what a tremendous dollar value it represents! Shpg. Wt. 4 lbs.

MODEL XR-1
$34.95
(Less batteries)
(With cabinet)

HEATHKIT BROADCAST BAND RADIO KIT

This table-model broadcast radio is fun to build, and is a fine little receiver for your home. It covers the standard broadcast band from 550 to 1600 kc with good sensitivity and selectivity. The 5½" PM speaker provides surprisingly good tone quality. High-gain IF transformers, miniature tubes, and a rod-type built in antenna, assure good reception in all locations. The power supply is transformer operated, as opposed to many of the economy "AC-DC" types. It's easy to build from the step-by-step instructions, and the construction manual includes information on operational theory, for educational purposes. Your success is assured by completely detailed information which also explains resistor and capacitor color codes, soldering techniques, use of tools, etc. A signal generator is recommended for final alignment. Shpg. Wt. 10 lbs.

Cabinet: Fabric covered cabinet with aluminum panel as shown. Shpg. Wt. 5 lbs. Part no. 91-9A. $4.95.

MODEL BR-2
$18.95
(Less cabinet)

HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

HEATHKIT TRANSISTOR RADIO DIRECTION FINDER KIT

protects against possible explosion and fire from undetected fuel vapor

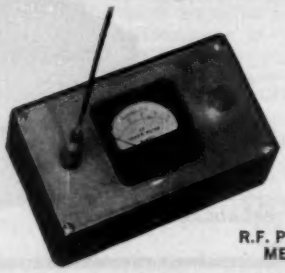
FUEL VAPOR DETECTOR

detects electrolysis currents which cause deterioration of underwater metal fittings on your boat

ELECTROLYSIS DETECTOR

indicates condition and charge of batteries for safe cruising

BATTERY CHARGE INDICATOR



R.F. POWER METER

HEATHKIT FUEL VAPOR DETECTOR KIT

Protect your boat and its passengers against fire or explosion from undetected fuel vapor by building and using one of these fine units. The Heathkit Fuel Vapor Detector indicates the presence of fumes on a three-color "safe-dangerous" meter scale and immediately shows if it is safe to start the engine. A pilot light on the front panel shows when the detector is operating, and it can be left on continuously, or just used intermittently. A panel control enables initial calibration of the detector when installed. Features a hermetically-sealed meter with chrome bezel, and a chrome-plated brass panel. It is very simple to build and install, even by one not having previous experience. Models FD-1-6 (6 volts DC) and FD-1-12 (12 volts DC) operate from your boat batteries. The kit is complete in every detail, even to the inclusion of a spare detector unit. Shpg. Wt. 4 lbs.

6 volt MODEL FD-1-6
12 volt MODEL FD-1-12
$35.95 EACH

HEATHKIT BATTERY CHARGE INDICATOR KIT

The Heathkit model CI-1 Marine Battery Charge Indicator has been designed especially for the boat owner, although it has found use in service stations, power stations, and radio stations where banks of batteries are kept in reserve for emergency power. It is intended to replace the hydrometer method of checking storage batteries, and to eliminate the necessity for working with acid in small, below-decks enclosures. Now it is possible to check as few as one, or as many as eight storage batteries, merely by turning the switch and watching the meter. A glance at the meter tells you instantly whether your batteries are sufficiently charged for safe cruising. Dimensions are 2-7/8"W x 5-11/16" H x 2" D. Operates on either 6 or 12 volt systems using lead-acid batteries, regardless of size. Simple installation can be accomplished by the boat owner in fifteen minutes. Shpg. Wt. 3 lbs.

MODEL CI-1
$16.95

HEATHKIT ELECTROLYSIS DETECTOR KIT

The Heathkit model ED-1 Electrolysis Detector indicates the extent of electrolysis currents between the boat's common ground and underwater fittings, except on boats having metal hulls. These currents, undetected, could cause gradual corrosion and deterioration of the propeller or other metal fittings below the water line. It is particularly helpful when installing electrical equipment of any kind, or to determine proper polarity when power is obtained from a shore supply. Easy-to-build, the model ED-1 consists of a hermetically-sealed, waterproof meter, special sensing plate, and sufficient wire to install, including the necessary hardware. Mounts on instrument panel where it can be easily seen. Requires no power for operation, and gives instant warning to guard your boat for a lifetime. Shpg. Wt. 2 lbs.

MODEL ED-1
$9.95

HEATHKIT RF POWER METER KIT

The Heathkit RF Power Meter Kit is designed to sample the RF field in the vicinity of your transmitter, whether it be marine, mobile, or fixed. Output meter is merely placed in some location close to the transmitter, to pick up RF radiation from the antenna. Requires no batteries, electricity, nor direct connection to the transmitter. It provides you with a continuing indication of transmitter operation. You can easily detect if power is dropping off by comparing present meter readings with past ones. Operates with any transmitter having output frequencies between 100 kc and 250 mc, regardless of power. Sensitivity is 0.3 volts RMS full scale, and a special control on the panel allows for further adjustment of the sensitivity. Meter is a 200 ua unit, mounted on a chrome-plated brass panel. The entire PM-1 measures only 3¾" W x 6¼" L x 2" D. An easy way to put your mind at ease concerning transmitter operation. Shpg. Wt. 2 lbs.

MODEL PM-1
$14.95

Heathkits...

By DAYSTROM

now offer you completely modern marine equipment with outstanding design features

PILOT

HEATHKIT TRANSISTOR RADIO DIRECTION FINDER KIT

The Heathkit Transistor Radio Direction Finder model DF-1 is a self-contained, self-powered, 6-transistor super heterodyne broadcast radio receiver incorporating a directional loop antenna, indicating meter, and integral speaker. It is designed to serve primarily as an aid to navigation when out of sight of familiar landmarks. It can be used not only aboard yachts, fishing craft, tugs, and other vessels which navigate either out of sight of land or at night, but also for the hunter, hiker, camper, fisherman, aviator, etc. It is powered by a 9-volt battery. (A spare battery is also included with the kit). The frequency range covers the broadcast band from 540 to 1600 kc and will double as a portable radio. A directional high-Q ferrite antenna is incorporated which is rotated from the front panel to obtain a fix on a station and a 1 ma meter serves as the null and tuning indicator. The controls consist of: tuning, volume and power (on-off), sensitivity, heading indicator (compass rose) and bearing indicator (antenna index). Overall dimensions are 7½" W x 5⅞" H x 5⅜" D. Supplied with slip-in-place mounting brackets, which allow easy removal from ship bulkheads or other similar places. Shpg. Wt. 5 lbs.

MODEL DF-1

$54.95

TRANSISTOR
RADIO DIRECTION FINDER

Heathkits...

By DAYSTROM

are sold only by direct mail, passing middleman profits on to you

Pioneer in "do-it-yourself" electronics

HOW CAN YOU MISS?

The Heath Company maintains a technical consultation service, should you experience some sort of difficulty in construction or operation. Although only a very small percentage of our customers ever have occasion to use this service (usually only beginners in electronics) it is still reassuring to know that technical help is available when needed. A service department is also available, should you wish a complete factory check of operation and alignment or repair. After you build your first Heathkit you'll realize how easy it is.

Free Catalog

Send for this informative booklet listing more than 100 "do-it-yourself" kits.

HEATH COMPANY A Subsidiary of Daystrom, Inc. **BENTON HARBOR 15, MICH.**

ORDER BLANK

NOTE: All prices subject to change without notice.

Enclosed find ( ) check ( ) money order for_____
Please ship C.O.D. ( ) postage enclosed for_____pounds.

On Express orders do not include transportation charges—they will be collected by the express agency at time of delivery.

ON PARCEL POST ORDERS include postage for weight shown. ORDERS FROM APO'S must include full remittance. All prices F.O.B. Benton Harbor, Mich.

Name_____

Address_____

City & Zone_____ State_____
(PLEASE PRINT)

SHIP VIA
- ☐ Parcel Post
- ☐ Express
- ☐ Freight
- ☐ Best Way

QUANTITY	ITEM	MODEL NO.	PRICE
		POSTAGE	
	☐ SEND FREE Heathkit Catalog	TOTAL	

PILOT

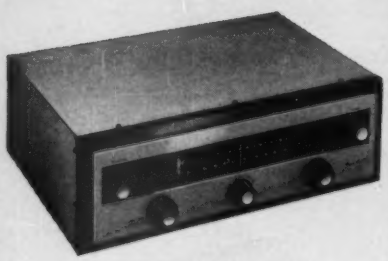
and only

PILOT

offers you peak performance in high fidelity at low cost

TUNERS

Traditional Pilot engineering and quality assure optimum performance. All Pilot tuners feature *Beacon* tuning for precise station selection. All Pilot tuners are also fully shielded to conform with FCC radiation specifications.



FA-550 FM-AM

Has tuned RF stage and dual cascade limiter-discriminator FM circuit for maximum sensitivity; — perfect quieting even with fringe signals; AFC with disabling switch; 10 KC filter for AM; flywheel tuning; built-in FM and AM antennas. Features preamp-audio control with five input channels; hum-free DC on tube heaters; tape head and phono inputs with separate equalization; bass and treble controls; separate cathode follower outputs for tape recorder and power amplifier. Housed in handsome enclosure finished in brushed brass and burgundy.

Dimensions: 4¾"h x 14½"w x 10¼"d.

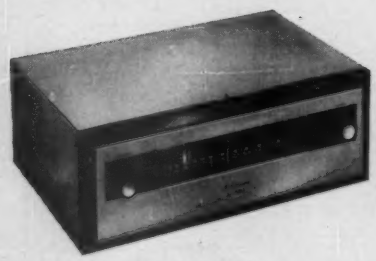
$159.50 Complete

FA-540 FM-AM

Has tuned RF stage for high sensitivity — perfect quieting even with fringe signals; AFC with disabling switch 10KC filter for AM; cathode follower output; phono and auxiliary inputs; flywheel tuning; built-in FM and AM antennas. Housed in handsome enclosure finished in brushed brass and burgundy.

Dimensions: 4¾"h x 13"w x 8¾"d.

$109.50 Complete



FM-530 FM Only

Has tuned RF stage for high sensitivity — perfect quieting even with fringe signals; AFC with disabling switch; cathode follower output; phono and auxiliary inputs; flywheel tuning; built-in antenna. Housed in handsome enclosure finished in brushed brass and burgundy.

Dimensions: 4¾"h x 13"w x 8¼"d.

$89.50 Complete

Make your own performance test of these tuners at your Pilot dealer.
For complete specifications, write to Dept. DW-12

Prices slightly higher west of Rockies.

Pilot RADIO CORP., 37-06 36th St., Long Island City 1, N. Y.

Over 38 years leadership in electronics.

ELECTRONIC NEWS FROM FRANCE

By **PROF. A. V. J. MARTIN**

IN the belief that U. S. electronics men are interested in what is going on in the field—no matter where it takes place—here is a brief report on things electronic in France.

Under the new five-year economic modernization plan, France's electronic industry is making an all-out effort to improve its position. The year 1954 has been taken as the reference and it is planned to double the reference gross sales to 500 million dollars and to quadruple the reference total exports to more than 75 million dollars by 1961. Simultaneously, imports will be considerably reduced to improve the import-export balance still further.

To spur the export drive, the French government carries on its policy of reduced taxes on exported goods. This helps the high-quality, but also high-priced, French equipment to be in a better competitive position on the international market.

The French electronic industry is largely composed of small firms, highly concentrated in or near the capital. Out of some 2000 firms, only 22 grossed more than 3 million dollars in 1955. Only ten firms employ more than 1000 persons only ten others more than 500.

ELECTRONIC SUBWAY CONTROL SYSTEM

An electronic control system using grid is undergoing extensive testing in the Paris "Metro." It automatically guides cars on the right way. Although no conclusions have been reached at this early stage of testing, the results are apparently gratifying.

ELECTRONIC CONTROL FOR CONVEYOR

One of the big French car manufacturers, Simca, had a problem in the painting chain. This has been solved by electronics, of course. Simca is having installed an automatic conveyor for its car bodies, with electronic control for safety and flexibility as well as economy. The cost will be around 1.5 million dollars.

SET PRODUCTION

Some 1,200,000 radio receivers were produced in 1956, bringing the total production to well over the 10 million unit mark. This means that practically every home in France now has at least one radio receiver. Although official statistics have not been released, it is estimated that 600,000 TV receivers were produced by the end of 1956.

BILINGUAL TV

The first bilingual television transmitter in the world started its program on Christmas Eve, 1956 at Algiers in French North Africa. The picture is accompanied by two commentaries, one in French and the other in Arabic—the language being selectable at will by the listener.

The system uses pulse duplex modulation of the sound carrier. The duplexing is locked in at the horizontal sweep frequency. —30—

build with the best...

JBL signature loudspeakers!

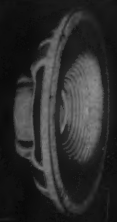
The careful work you do in building your high fidelity sound system will be shown off to best advantage if you use precision-made JBL SIGNATURE Loudspeakers. These are the most efficient units to be found anywhere, made with the most exacting care, meticulous attention to detail. Remember, it takes no more effort on your part to build with the best.

MODEL D130
15" Extended Range Loudspeaker

The only 15" extended range speaker made with a 4" voice coil is the world-famous JBL Signature D130. The large voice coil stiffens the cone for crisp, clean bass; smooth, extended highs. Your basic speaker, the D130 works alone at first, later becomes a low frequency driver when you add a JBL Signature high frequency unit and dividing network to achieve the ultimate excellence of a JBL Signature two-way system.

MODEL D208
8" Extended Range Loudspeaker

A precision transducer in every sense of the word, the famed JBL Signature 8" D208 is made with the same care and precision as the larger units in the James B. Lansing Sound, Inc., line. If space and cost are major considerations, the D208, properly enclosed, provides the most lastingly satisfactory sound you can get. It is widely used in top quality systems where extension speakers are desired for areas other than the main listening room.



MODEL D123
12" Extended Range Loudspeaker

With outstanding "presence" and clean response throughout the entire audio spectrum, the D123 features an unusual shallow construction. Only 3⅝" deep, it is designed to mount flush with the wall, between studding, in any standard wall or partition. Frequently, the D123 is used in multiples in "infinite baffle" wall installations. In this case the JBL Signature 075 is a logical high frequency unit to add when you advance to a two-way system.

MODEL 075
High Frequency Unit

Another exclusive for James B. Lansing Sound, Inc., is the ring radiator in the JBL Signature 075 high frequency unit. A ring, rather than a diaphragm, radiates into the annular throat of an exponential horn. The result is high frequency reproduction of unmatched smoothness and clarity, absolutely free of resonances and strident peaks. The horn is beautifully machined from aluminum, the entire unit a gratifying, solid piece of fine craftsmanship. Designed for crossover at 2500 cycles with the JBL Signature N2500 Network.

MODEL 175DLH High Frequency Assembly

The acoustical lens is only available on JBL Signature high frequency units. The 14 element lens on the 175DLH disperses sound within the listening area over a 90° solid angle, smoothly, with equal intensity regardless of frequency. The acoustical lens is the greatest contribution to life-like high frequency reproduction in 20 years, and it was developed for use with high fidelity equipment by James B. Lansing Sound, Inc. In addition to the lens the 175DLH consists of a high precision driver with complex phasing plug and a machined aluminum exponential horn. Designed for crossover at 1200 cycles with the JBL Signature N1200 Network.

JBL Signature Two-way Systems Are Available As Kits

D66 Kit This two-way system is made up of units which have been acclaimed by impartial authorities as the finest available anywhere today. Included in the kit are the 150-4C Low Frequency Driver, N500H Network, 375 High Frequency Driver, 537-509 Horn-Lens Assembly. These are the same units—including the serpentine acoustical lens—which are used in The Hartsfield . . . units designed originally for installation in the most modern theaters in the world.

There are many more kits and loudspeakers in the JBL Signature line. Whatever your needs, you will find exactly the right unit or system in the complete JBL Signature catalog. Send for your free copy. A limited number of technical bulletins are also available. Please ask only for those in which you are vitally interested.

JBL *means*
James B. Lansing Sound, Inc.

JAMES B. LANSING SOUND, INC., 2439 Fletcher Dr. • Los Angeles 39, Calif.
Please send me the following:
☐ Free Catalog of JBL Signature Products
☐ Name and address of Authorized JBL Signature Audio Specialist in my community
TECHNICAL BULLETINS ON:
☐ D130 ☐ D123 ☐ D208 ☐ 175DLH ☐ 075 ☐ 375 ☐ 150-4C
Name_____
Address_____
City_____ Zone____ State_____

Over 38 years leadership in electronics.

Hi-Fi-Audio Product Review

FOUR-SPEED CHANGER

Glaser-Steers Corporation, 20 Main St., Belleville, N. J. has recently introduced a new four-speed changer which the company claims combines turntable performance with changer convenience.

The "Seventy Seven" features the exclusive "Speedminder" which automatically selects correct turntable

speed and then the controls take over. With the standard groove stylus in play position, the changer operates automatically at 78 rpm but when the microgroove stylus is in place the changer operates at 33 and 45 rpm. It will handle these two speeds intermixed without regard to size or sequence. The change cycle is 5 seconds.

Shock suspension prevents vibration feedback through the arm pivot and resonance is negligible. The arm itself has an easily accessible vernier adjustment for stylus pressure and a finger lift for record protection.

The unit comes with arm but less cartridge. A base and mounting board, if needed, are available at extra cost.

V-M STEREO TAPE MACHINE

V-M Corporation, 280 Park St., Benton Harbor, Mich. has begun shipping its first popular-priced stereo-play tape recorder which will handle both stacked and staggered stereophonically recorded tapes.

The Model 714 is styled in smart two-tone gray and is a dual-track, dual-speed recording and playback unit. The stereo playback feature is a "plus." The unit has push-button controls, a precision tape index counter, and two speakers. A "cathoptic" tuning eye is incorporated for simple visual volume adjustment in making recordings. Write the manufacturer for full details.

"LITTLE GENIE" KITS

Grommes Division of *Precision Electronics, Inc.,* 9101 King St., Franklin Park, Ill. has recently introduced a new series of audio kits which the company claims can be assembled by the nontechnical music lover as easily as by the audiophile.

The "Little Genie" kits feature layer-built assembly and a complete color

guide which facilitates construction. Currently in the line are the 207AK preamp; the LJ-6K 10-watt amplifier; and the 250K, a 50-watt basic amplifier designed to be used with a preamp like the 207AK.

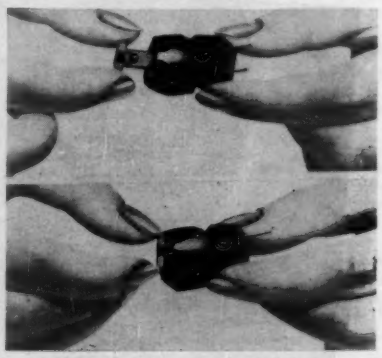
The preamp, shown in the photo, features ten separate controls, over-all feedback for low distortion and wide frequency response, cathode-follower output, and a self-power feature for use with any basic amplifier.

The company will release additional kits from time to time. Complete details on current units will be supplied by the manufacturer on request.

NEW PICKERING UNITS

Pickering & Company, Inc., Oceanside, New York has introduced two new items of interest to audiophiles.

The first unit is the "T-Guard" stylus which carries its conical diamond stylus



in the center of a molded high-impact phenolic plastic to eliminate danger of stylus damage. Measuring ½" high by ½" across the "T" bar, this new assembly eliminates groping for a tiny stylus and prevents precarious fingernail fumbling. Ten different styli are available in this new line.

The second item is a new single "Fluxvalve," the Series 370. Measuring only ⅝"x⅝"x1", the new magnetic cartridge will mount into any type of high-fidelity pickup arm having ½" mounting centers. The Series 370 incorporates the "T-Guard" feature.

Frequency response is flat from 10 to 30,000 cps. It has an output of 25 μv. at 1000 cps and feeds into a recommended load of 27,000 ohms. Hermetically sealed, it weighs only 9 grams and, depending on the pickup arm used, will track from 2 to 6 grams. Information on either or both of these items may be obtained by writing Dept. P-1-2 of the company.

TWIN-LEVER CARTRIDGE

Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill. has announced a new twin-lever ceramic cartridge which has been especially designed to facilitate the upgrading of standard phonographs.

The new unit can replace all ceramic cartridges. It is a three-speed, dual-needle assembly with a response from 30 to 15,000 cps. Two separate needles mounted on a single holder are included in the cartridge—a 1-mil stylus for 33⅓ and 45 rpm records and a 3-mil stylus for 78 rpm discs.

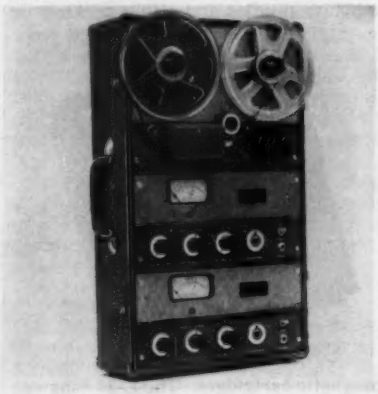
The needle assembly is easily re-

placed by unscrewing a single knurled screw. A novel needle-shifting mechanism anchors the needle in use firmly while absorbing vibration from the disengaged needle.

AMPEX STEREO RECORDER

Ampex Corporation, 934 Charter St., Redwood City, Calif. has developed a portable two-track stereophonic recorder, the Model 601-2.

The new unit uses precision in-line heads for recording and reproducing.



Interchannel crosstalk is below the inherent noise level while separate microphone and line inputs and level controls on each channel permit stereophonic mixing. The unit records both stereo and single-channel tapes and plays back stereo, full- or half-track tapes. Plug-in transformers are available for low-impedance microphone operation.

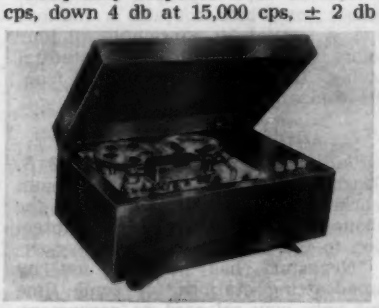
The recorder is housed in a carrying case which measures 8"x13"x24½" and weighs 42 pounds. A data sheet on the unit is available on request.

STEREO TAPE RECORDER

Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y. is now marketing the "Tancordex" stereo tape recorder.

Designed by K. Tani, the new unit has a precision-built, twin-track mechanism; features three motors for drive, fast-forward, and rewind; and has three shielded heads for record, playback, and erase.

Frequency response is 40 to 15,000 cps, down 4 db at 15,000 cps, ± 2 db



from 40 to 10,000 cps. Wow and flutter is less than .17%. Signal-to-noise ratio is better than 50 db. The fine-gap, low-impedance recording heads are double Permalloy shielded.

The self-contained binaural playback amplifier has a dual, low-impedance

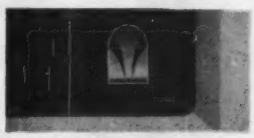
NEW

New AM-FM Tuner puts wide band FM, wide range AM within your budget!

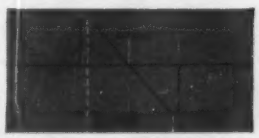
Completely new in styling . . . in engineering . . . in performance . . . the H. H. Scott model 300 AM-FM tuner embodies many new engineering features found nowhere else.

- Selectivity is superior to conventionally designed tuners because of the wide-band detector.
- Circuitry is completely drift-free . . . without the need for troublesome AFC.
- Cross-modulation is minimized so strong local stations do not appear at several points on the dial.
- AM section features wide-range circuitry. Reception is so good on fine AM stations you'll think you are listening to FM.

When you tune the H. H. Scott 300 to a weak FM station next to a strong one, it stays in tune perfectly. Ordinary tuners using AFC rather than Wide-Band, wander from the weak station to the strong, making it impossible to tune to weak stations. Smooth acting slide-rule dial is extra-long giving better band spread, so stations are easy to separate.



Precision-ray tuning eye makes it simple to tune precisely on both AM and FM.



Wide-band FM circuitry eliminates co-channel and adjacent channel interference — makes tuning drift-free.

Famous musicians like Metropolitan Opera singer Jerome Hines choose H. H. Scott components for their own homes.

Additional Technical Information — Model 300

FM sensitivity 3 microvolts for 20 db of quieting; 2 megacycle wide-band detector; 10 kc sharp-tuned whistle filter; outputs — main, multiplex, tape; tuned RF stage insures high sensitivity and selectivity on both AM and FM; two position AM bandwidth for Normal and High Fidelity programs; size in mahogany accessory case 15½w x 5h x 12½d. $159.95. Choice of handsome accessory cases at $9.95 and $19.95.

The new 300 is a perfect match to H. H. Scott's Best Buy Amplifier . . . the famous "99". This 22 watt complete amplifier is only $99.95. This means that for only $259.90 you can have a complete H. H. Scott system.

h. h. Scott

H. H. Scott, 111 Powdermill Road, Maynard, Mass.

Export Dept: Telesco International Corp., 36 West 40th Street, New York City

NAME.....

ADDRESS.....

CITY.....STATE.....

AUDAX TONEARM KIT

A screwdriver... 15 minutes of your time... and the fabulous Audax tonearm kit — that's all you need to own your own compass-pivot Audax Professional Tonearm *at a big saving!* You'll find accurate assembly of this exclusive kit a very simple affair — with assurance that the final result will be as fine as factory-assembled units! Use any cartridge with your Audax arm. Thrill to the wonderful new difference it makes in your high fidelity system — a difference that confirms your wise choice in owning one of the finest tonearms ever made!

At your dealer { 12" Tonearm Kit **$14.55**
16" Tonearm Kit $17.55

BEST RECORD PROTECTION INSURANCE—
Audax "Micro-poise"... the gram weight scale with "prescription" accuracy! $3.95

AUDAX Div. of Rek-O-Kut Co., Inc., 38-19 108 St., Corona 68, N. Y.

cathode-follower output of 1.3 volts. The entire deck is of stainless steel mounted in a finished cabinet with removable, hinged lid.

PORTABLE RECORD PLAYER

Rek-O-Kut, Inc., 38-19 108th St., Corona 68, New York has just introduced a portable record player which combines its A-120 arm with the L-34 and CVS-12 turntables to provide a complete unit.

The players are equipped with dual sapphire needles and either ceramic or

magnetic cartridges. The L-34 (shown) plays at 33 or 45 rpm, while the CVS-12 permits continuous speed variations from 25 to 100 rpm without resetting or stopping the record.

The players operate from 60-cycle, 110-120 volt lines and are designed to operate into any amplifier for dubbing records onto tape, wire, or discs. They are mounted in sturdy plywood, leatherette-covered cases.

COLORED LEADER TAPE

Reeves Soundcraft Corporation, 10 E. 52nd St., New York, N. Y. has introduced new colored Mylar base leader tape which is designed to protect and identify valuable tape recordings.

The new leaders are available in gold, red, white, and blue. When spliced at the beginning of the reel, the color of the tape identifies the subject matter. Interspliced throughout the reel, the colors indicate where various selections start and finish.

The new tape is packaged in a dispenser box which contains a 150-foot reel. A special kit containing all four colors is available at a substantial saving. Literature is available from the company.

ANTI-STATIC LUBRICANT

Phillips and Phillips Corp., 343 S. Dearborn St., Chicago, Ill. has begun marketing its anti-static lubricant for phonograph record and needle protection to the public.

"Negastat" has been in use by broadcasting stations for some time but only now released to consumers. The lubricant cleans and renders records and transcriptions free from static and stops dust attraction. By actually lubricating the record grooves, the new product is said to add approximately 40 per-cent to the life of the

CITY.....STATE.....

needle, double the life of the record, and enhance tone quality.

The product can be used on all types of records and is non-inflammable. A six ounce bottle will treat 1000 records.

"CAR-FI II"

Empire Electronics, Inc., 22022 Woodward Ave., Ferndale 20, Mich. has recently released its "Car-Fi II," a rear seat speaker designed for convertibles and sport cars.

The housing is of high impact, high-gloss styrene, injection molded to insure ruggedness. The speaker is a 2½" x 10" unit of radical design. The cone is silicone treated to resist water damage. The entire unit measures 14⅜" wide, 3¾" high, 3¼" deep. It comes in ivory.

In addition to its application in cars, it may be used as a relay speaker for music or call systems in public and commercial buildings, boats, aircraft, schools, and homes.

UNIQUE IMPORTED SPEAKER

Videola-Erie, Inc. of Brooklyn, N. Y. is now importing a unique bi-stereo external speaker from West Germany for the U. S. trade.

The speaker enclosure may be used with any record player, tape recorder, TV, radio, or sound system. The highs emanate from one end and the lows from the other. Known as "two-channel stereophonic radiation," it offers 20-watt output, 5-ohm impedance, and

will cover up to 15,000 cps. A jack is supplied for use with any American or German-made units.

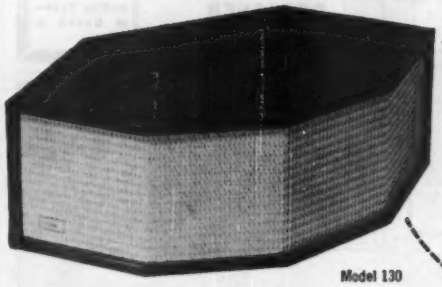
The speaker measures 15" in length and is 4" in diameter. It weighs 1½ pounds. Coverings are of a plasticized natural bamboo cloth or mahogany gold.

WHARFEDALE 3-WAY SYSTEM

British Industries Corporation, 80 Shore Road, Port Washington, N. Y. is handling the U. S. distribution of the new ready-to-play *Wharfedale* 3-way speaker system, designated as the SFB/3.

Developed by G. A. Briggs, the new system includes special 12", 10", and 3" loudspeakers, tuned and integrated with a sand-filled baffle. The new system is omni-directional even when free standing. By using three speakers with voice coils of different resistances, it has been possible to vary

JansZen* Electrostatic



Model 130

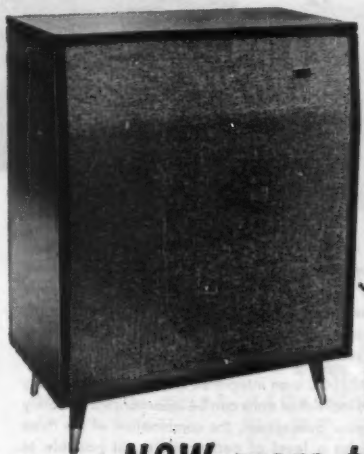
New listening pleasure awaits you when you hear music over the JansZen Electrostatic. Transient response reaches a perfection hitherto unknown, record scratch is reduced because it excites no audible resonances and clarity and realism are maintained at all listening levels.

JansZen* DYNAMIC

The JansZen Dynamic sets new standards in cone woofers. Unique design concepts, combined with new materials has resulted in a woofer system which can be used singly or in pairs with the JansZen Electrostatic.

Model 250 measures only 18¾" high (exclusive of legs) by 24¼" wide by 14" deep

The Z-200 System



A complete range loudspeaker system using the incomparable JansZen Electrostatic mid and high range speaker (Model 130U) with the new JansZen Dynamic. Here is a loudspeaker of nearly perfect naturalness incorporating the latest advances in the art of music reproduction. Its design simplicity makes it suitable for use with either traditional or contemporary décor.

Model Z-200 measures only 32" high (including 4" legs) by 24¼" wide by 14" deep

NOW more than ever...

Hear the Music, not the Speaker

* Designed by Arthur A. Janszen

Write for literature and the name of your nearest dealer

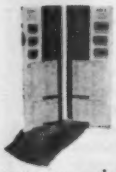
Products of NESHAMINY ELECTRONIC CORP., Neshaminy, Pa.

Export Division: 25 Warren Street, N.Y.C. 7 • Cable Simontrice, N.Y.

netic fields. This filament structure |

CAPACITOR KIT

handles 90% of ceramic capacitor needs



The Sprague "Universal" Ceramic Capacitor Kit CK-4 contains 12 "Universal" Ceramic Capacitors . . . just four of these capacitors take the place of forty-two regular capacitors, with capacitance values from 400 μμF to .015 μF. Handy card tells how to connect leads to get capacitance you need. Only $3.96 net. See your jobber or send check or money order to SPRAGUE PRODUCTS CO., 51 Marshall St., North Adams, Mass.

TAPE RECORDERS

HI FI COMPONENTS
Tapes—Accessories
UNUSUAL VALUES
Send for Free Catalog
DRESSNER
69-02 RA-174 St.
Flushing 65, N. Y.

MERITAPE
Low Cost, High Quality Recording Tape—in boxes or cans.

MORSE CODE

Sending • Receiving • Speed
Complete Instructions. Made Easy with 45 or 78 RPM Record.
7 INCH 45 RPM . . SEND $1.25
12 INCH 78 RPM . . SEND $2.25
Prices Include Postage and Handling
UNCLE SAM RECORDings • Dept. C-12
59 East Van Buren Street, Chicago 5, Illinois
Sold by leading hobby shops, radio-electronic dealers, hi-fi record shops, chain and department stores everywhere. Dealer, Jobber and Mail Order Firms Inquiries Invited.

Recorder-Stereophonic Reproducer—Two-speed, precision-built tape transport, capable of playing over 4 hours from a single 7" reel of tape; *sustained* frequency response 30-16,000 cps (7½ ips), with dynamic range over 55 db; Flutter and wow under 0.25% rms at 7½ ips; Precision timing accuracy affords perfection of pitch held to tolerances of less than ⅓ of a half tone at highest frequencies.

Amplifier-Speakers — Electronically and acoustically matched for optimum reproduction of stereo and monaural sound. These units deliver more undistorted sound per watt than the great majority of 12" and 15" speakers available today. Environmental inverse feedback from speaker voice coil circuit to cathode of first amplifier stage affords improved damping, lower distortion. Tilt-out push-button control panel for selecting input (Tape, TV, Tuner, or Phono); bass, treble and volume controls.

Complete Specifications—Information on the units shown above, plus consoles, portables, and unmounted units, available in free new full-color brochure.

Here is a stereo system you'll be as proud to show as you will to operate. The Ampex A121-SC Modular home music system was designed to satisfy not only the needs of the audio perfectionist, but also the increasing desire for a system that is as pleasing to the eyes as it is to the ears.

The A121-SC is an *integrated* system, and though any of the individual units can be incorporated smoothly into your own system, the combination of the three provides a level of performance not possible to achieve by any other means.

AMPEX AUDIO, INC.
1044 KIFER ROAD,
SUNNYVALE, CALIFORNIA
Please send free color brochure to:

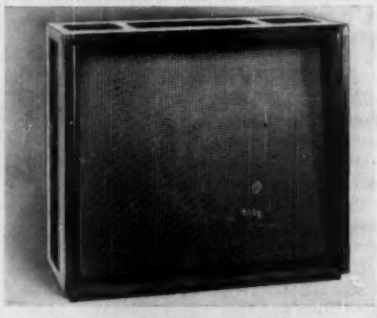
NAME

ADDRESS

CITY

the current flowing through each speaker and thus obtain a balanced over-all performance.

Two styles are currently available,

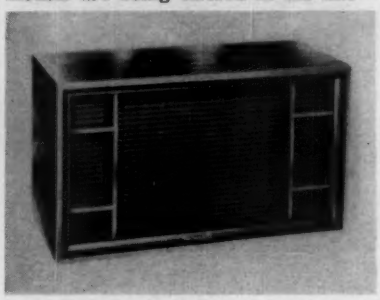


the "Warwick" custom and the "Windsor" deluxe (pictured). The engineering principles and speakers used are the same in both models but the outward cabinet appearance varies. Each model is available in walnut, mahogany, or blonde finishes. Write Dept. K31 of the distributor for full details, prices, and specifications.

"ULTRA-LINEAR" SPEAKER SYSTEMS

University Loudspeakers, Inc., 80 South Kensico Ave., White Plains, N. Y. unveiled a new line of "Ultra-Linear" speaker systems at the Hi-Fi Show in New York.

Housed in small, compact, and convenient-to-place enclosures, the speaker components have been designed to provide especially good bass response for so small a unit. Currently two models are being offered in the line—



one for a 15" loudspeaker (Model S-11H) and the other for 12" units (Model S-10L).

The company will supply full specifications on these new systems for apartments, rumpus rooms, and other restricted-space applications, upon written request.

NEW ECC SERIES TRIODES

Amperex Electronic Corporation, 230 Duffy Ave., Hicksville, N. Y. has announced a new ECC series of twin triodes, designed as plug-in replacements for the 12AT7, 12AU7, and 12AX7.

Available at no greater cost than their conventional equivalents, these tubes are being offered as part of a new "preferred" series for audio applications.

According to the company, the new tubes have lower hum level because the filaments are wound as double helicals with mutually cancelling mag-

HF61 master control preamp; HF60

netic fields. This filament structure also contributes to longer tube life since it eliminates sharp bends. Lower tube noise and lower microphonics are due to the greater rigidity and immobility of the internal tube structures.

CABLES FOR AUDIO

Belden Manufacturing Company, Chicago 80, Ill. has announced the development of several new cables which have been designed specifically for audio applications.

Codes 8403, 8404, and 8405 are plastic insulated versions of several of the more popular rubber-covered mike cables. They are particularly recommended for use in high concentrations of ozone. All have 20 gauge, stranded tinned copper conductors, polyethylene insulation, tinned copper braided shields, and chrome vinyl jackets.

The second development involves a hi-fi pickup arm cable which has 32-gauge, stranded bare copper conductors, vinyl insulation, and two-conductor cables. Catalogued as the 8430, the cable is color coded in black and red for foolproof connections.

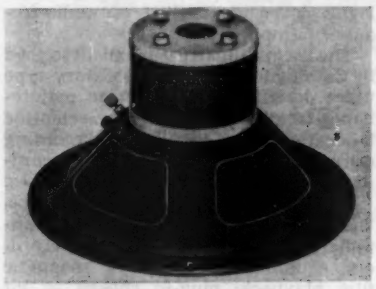
Details on all of these audio cable items are included in the company's new #857 "Electronic Wire and Cable Catalogue" which is available on request.

"POLYMERIZED CONE"

Hartley Products Company, 520 E. 162nd Street, New York 51, N. Y. has developed a new speaker that employs the new "Polymerized Speaker Cone."

It is the result of a new and exclusive process whereby paper is taken as a raw material and is treated chemically, then baked until it is given a toughness and rigidity to provide improved "attack." The company claims that clearer, flatter response and absence of resonance results.

In general, the other specifications of previous *Hartley* speakers are retained in this model which has been designated as the "217" to indicate that the special cone construction is incorporated.



AUDIO CATALOGUES

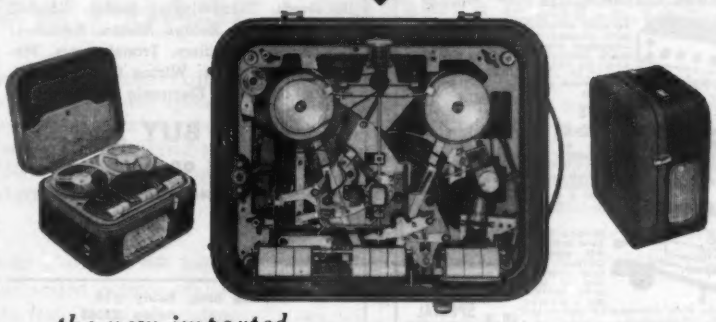
EICO'S AUDIO LINE

Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, N. Y. has just released a 6-page catalogue describing its line of hi-fi gear which is offered in both kit and factory-wired form.

Full specifications are given on the

It sounds like this...

because it's built like this!



the new imported

NORELCO® 'CONTINENTAL'

world's most advanced all-in-one portable

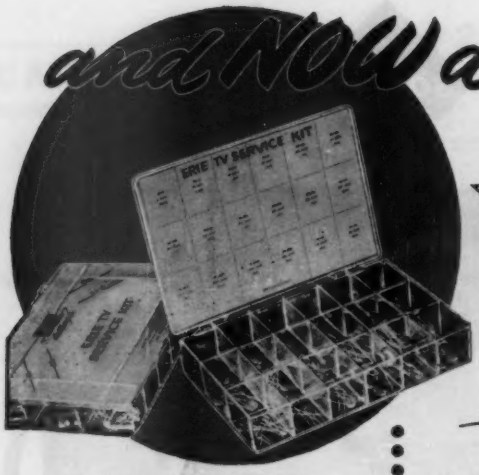
TAPE RECORDER

For the name and address of your nearest Norelco dealer, write to Dept. 0

NORTH AMERICAN PHILIPS CO., INC.
High Fidelity Products Division
230 DUFFY AVENUE,
HICKSVILLE, L.I., N.Y.

Norelco

Engineered by Philips of the Netherlands, world pioneers in electronics
Precision-crafted by Dutch master technicians
Styled by the Continent's top designers
Three speeds (7½, 3¾ and 1⅞ ips)... twin tracks... push-button controlled
Special narrow-gap (0.0002 in.) head for extended frequency response
Built-in, wide-range Norelco speaker
Also plays through external hi-fi set



and NOW a NEW

ERIE CERAMICON® TV SERVICE Kit

HERE'S WHAT YOU GET

1. 63 High Stability ERIE Disc or Tubular Ceramicons
2. 18 Popular Values
3. Handy, Convenient 18 Section Plastic Storage Case
4. Exceptional Value

HERE'S WHAT YOU SAVE

REGULAR PRICE

63 Piece ERIE Ceramicon Assortment $15.00
18 Section Plastic Case 1.75
Total Value $16.75

YOU PAY $10.65
YOU SAVE ..... $ 6.10

ORDER NOW From Your ERIE DISTRIBUTOR

ERIE Electronics Distributor DIVISION
ERIE RESISTOR CORPORATION
ERIE, PA.

REVOLUTIONARY VALUES AT

CENTER ELECTRONICS

Leaders in Audio

HARMAN-KARDON PC-200 — NET $55.00 — CENTER PRICE $36.95

10-watt amplifier with preamplifier—brushed copper, black enclosure—4½" H. 7¼" D. 12⅜" W. .....

THE PRELUDE—very limited quantity on this unit.

STEPHENS TRUSONIC 80 FR

The finest 8" full range speaker ever made. 40-15,000 cps—power continuous—20 watts voice coil 2"—magnet: 1 lb.... $31.50

CONTACT US FOR OUR PRICE

WEATHERS MM-1

Micro-touch tone arm and FM pickup—Deluxe system consisting of tone arm, oscillator - power supply with diamond LP stylus and leads. Audiophile $82.10

SPECIAL PRICE ON REQUEST

MIRACORD XA-100

3 speed, with push-button control and "magic wand" spindle—A precision instrument for both manual and automatic reproduction—THE FINEST BY FAR! $67.50 $46.95

NEW G-E VR II 4G-052 — NEW Full-range reproduction. Frequency range from 20 through 20,000 cycles. NEW 4-gram tracking force. NEW electrostatic shielding.

RECORDING TAPE
1,200 ft. ACETATE $1.39
1,800 ft. ACETATE 1.98
1,800 ft. MYLAR 2.57

ASK FOR Sonotape PRE-RECORDED TAPE Catalog

Mail Orders 25% Deposit, Balance C.O.D.
BASIC AMPLIFIERS • TUNER AMPLIFIERS • PREAMPS • PICKUP ARMS • SPEAKERS • SPEAKER ENCLOSURES • RECORD CHANGERS • TAPE RECORDERS • CARTRIDGES • TURNTABLES • ETC. GET OUR SPECIAL PRICES.

CENTER ELECTRONICS CO., Inc.
Dept. MZ, 72 Cortland St., New York 7—CO 7-6474

Special price paid for R.C. 286 Antenna

SELLING

Receivers, Transmitters, Radar, Special Purpose Tubes, Relays, Meters, Switches, Connectors, Rectifiers, Transformers, Motors & Generators, Wiring Cable, Instruments and All Electronic Components.

WILL BUY ALL

New or Used

Leach Relay #5059-R
#5058
#5055
#5053-SM
#5053

Price Bros. Relay #10
Relay #5586
#5587

Antenna Switching Relay Box # CBY 23049
BG-AN-198
BC -408

Tubes #53A
VT-127A VT-227A
35T VT-327A
WL-530 15E

Highest prices paid for most all types of aircraft sparkplugs, magnetos and magneto breaker points.

Wholesale Only

RADIO & ELECTRONIC SURPLUS

14000 BRUSH STREET

Detroit 3, Mich. TO 9-3403

HF61 master control preamp; HF60 60-watt "Ultra-Linear" power amplifier; HF50 50-watt "Ultra - Linear" power amplifier; HF20 20-watt "Ultra-Linear" Williamson-type integrated amplifier; HF12, the 12-watt version of the HF20; and the HFS1 two-way speaker system. Copies of the catalogue are available free. Ask for Form A5.

"THIS IS HIGH FIDELITY"

Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill. has just published an elaborate revised edition of its popular consumer publication, "This is High Fidelity."

Assuming no previous background knowledge on the part of the reader, the text clearly explains high-fidelity reproduction of voice and music from the simplest of basic hi-fi components to the new world of stereo sound.

The two-color booklet is lavishly illustrated with line drawings and photographs. It may be obtained from the company for 10 cents a copy. When writing please specify stock number 39-K-000.

UNIVERSITY CATALOGUE

University Loudspeakers, Inc., 80 S. Kensico Ave., White Plains, N. Y. has just issued a 12-page catalogue covering its line of hi-fi, commercial, and industrial speakers, systems, and accessories.

Pertinent specifications are included for each model in the line along with photographs of the units and line drawings showing suitable mountings. Frequency response, power capacity, impedance, dispersion, sound pressure level, sensitivity as a microphone, dimensions, weight, and list prices on the various units are presented in tabular form of maximum usefulness.

A.F. AMPLIFIERS

The *Cinema Engineering Division* of *Aerovox,* 1100 Chestnut St., Burbank, Calif. has just issued a 12-page catalogue covering its line of audio-frequency amplifiers.

The items illustrated and described in Catalogue 16-C are laboratory type units designed especially for maintenance-free sound systems, scientific laboratories, tape and disc recording companies, motion picture film recording applications, and other critical uses.

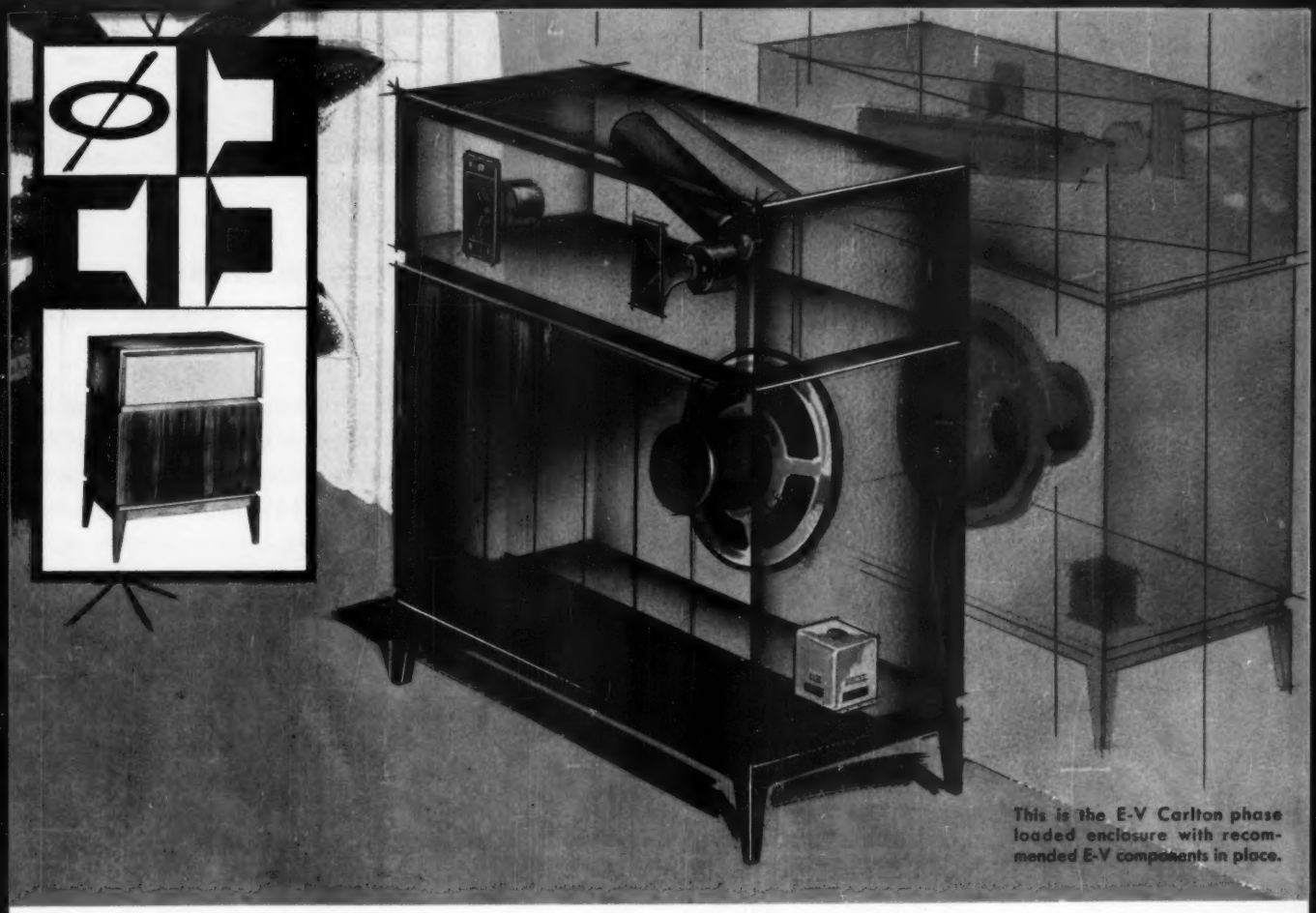
The brochure covers preamps, "boom" microphone preamps, line amplifiers, oscillators for magnetic recorders, equalizer-amplifiers for magnetic film playback, plug-in chassis in kit form, mounting frames, and power supplies.

MUSICRAFT SPECIALS

MusiCraft, 48 East Oak St., Chicago 11, Ill. has issued a 4-page flyer which describes various audio items being offered at the present time.

Included are specially priced 10- and 20-watt amplifiers, two speaker systems, record accessories, and tape accessories. Copies of the flyer will be forwarded on request. -30-

DESIGNS FOR



This is the E-V Carlton phase loaded enclosure with recommended E-V components in place.

Electro-Voice® MAKES HI-FI HISTORY WITH EXCITING NEW PHASE LOADED ENCLOSURES

For the first time—and only from Electro-Voice—you get performance from along-the-wall speaker enclosures which approaches the performance of a corner horn! E-V does it with the exciting new principle of PHASE LOADING, the most important advance in baffle design since the Folded Corner Horn!

Designed specifically for use along a wall, phase loaded cabinets give you almost a full added octave of bass range and completely eliminate the "boomy" characteristic of bass reflex enclosures.

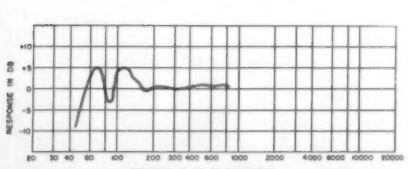
Flat, fundamental response is obtained *two* ways with *PHASE LOADING:*

First, by placing the driver at the rear of the cabinet close to the floor, and facing the wall. The wall and floor act as reflecting surfaces, close and almost equidistant from the driver cone, eliminating phase difference between reflections and the source.

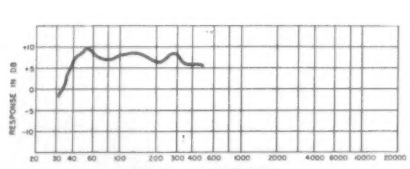
Secondly, *Phase Loading* permits a sealed cavity behind the cone, of precise volume. The compliance of this cavity, in conjunction with the mass of the cone, is made to react with the mass and compliance of the outside air throughout the second octave, adding this range to the response not otherwise attainable except through corner horns.

The low crossover of 300 cps makes this system possible, for higher frequencies are not propagated properly by indirect bass radiators.

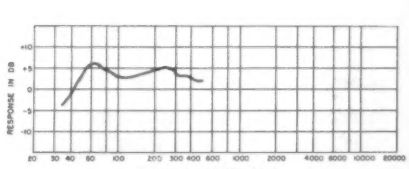
The application of these principles in E-V's PHASE LOADING gives full-bodied, extended low-bass hitherto unavailable. Musical balance is achieved for the first time in an along-the-wall system.



This curve shows performance of the usual 4-way systems in a bass reflex cabinet. Note the dip at 85 cps, which shows the destructive cancellation and the reinforcement (peak) at 120 cps which causes "boom."



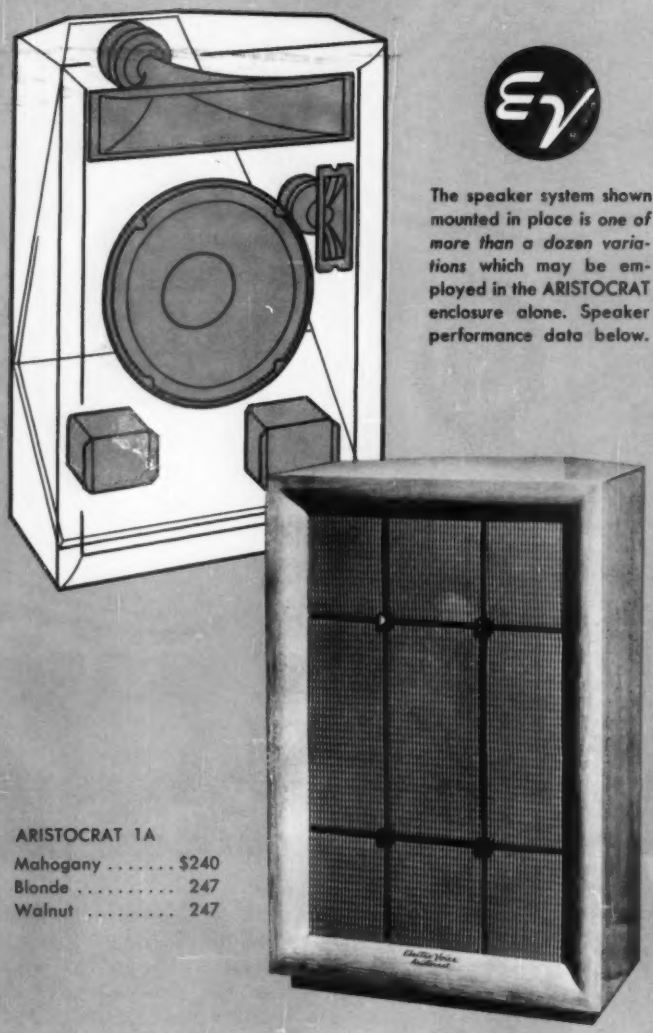
This curve shows the smoothness throughout, the extra response and the extended bass response you get *only* from a folded horn corner enclosure.



This is E-V phase loading. As you can see, performance in an along-the-wall position closely approaches that of the corner horn.

FOLDED HORNS

DESIGNS FOR



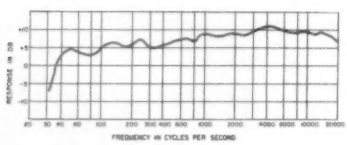
The speaker system shown mounted in place is one of more than a dozen variations which may be employed in the ARISTOCRAT enclosure alone. Speaker performance data below.

ARISTOCRAT 1A

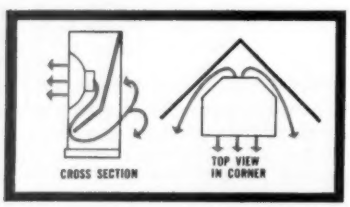
Mahogany	$240
Blonde	247
Walnut	247

THE DIRECT RADIATOR CORNER HORN

Typical of Electro-Voice direct radiator folded horn corner enclosures is the ARISTOCRAT, a deluxe space-saver designed for use with E-V 12-inch coaxial speakers, TRX integrated three-way speakers or your choice of speaker systems. It is designed for use in a corner, where the walls of your room serve as extensions of the bass horn to deliver one full extra octave of bass range. Increased power-handling in the lower range is as much as 50%.



This E-V ARISTOCRAT, like the full line of Electro-Voice corner enclosures, makes use of room walls and corner to propagate lowest bass tones. Curve shows smooth, flat response.

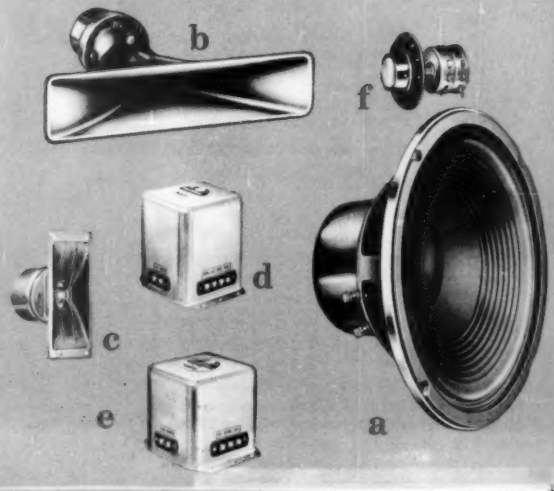


The folded corner horn drawings here show the sound path from direct radiators.

Integrated Speaker Systems

This is the Electro-Voice 108A *direct radiator* speaker system shown in the ARISTOCRAT enclosure above. It's an economy 3-way system employing (**a**) 12BW low-frequency bass driver; (**b**) T10A treble driver with 8HD horn for mid-range reproduction; (**c**) T35B very-high-frequency driver for silky highs; (**d**) X825 crossover; (**e**) X36 crossover; (**f**) two AT37 level controls plus wiring harness and baffle board. Crossovers are at 800 cps and 3500 cps, lowering intermodulation distortion and assuring optimum operation of each element in the system. Complete, ready to install, Net $168.

INTEGRATED

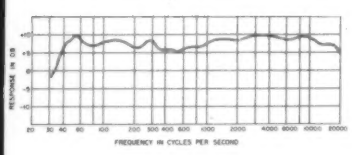


FOR HI-FI ON A BUDGET, FOLLOW THE

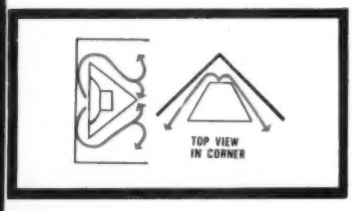
R FOLDED HORNS

THE INDIRECT RADIATOR CORNER HORN

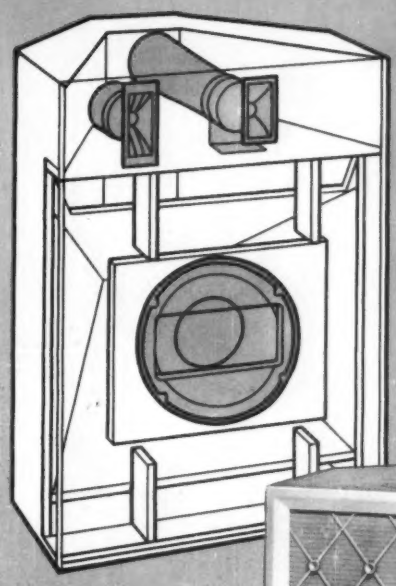
Using an advanced indirect horn-radiator principle E-V design extends the lows, enhances highs, uses room walls as extensions of the exponential horn air load. Indirect radiation and employment of low crossover frequency, allows exploitation of the sealed cavity feature explained on Page 1. These enclosures actually assure more than one full octave of added bass with unprecedented efficiency, provide direct front radiation of higher frequencies, cleaner overall musical balance.



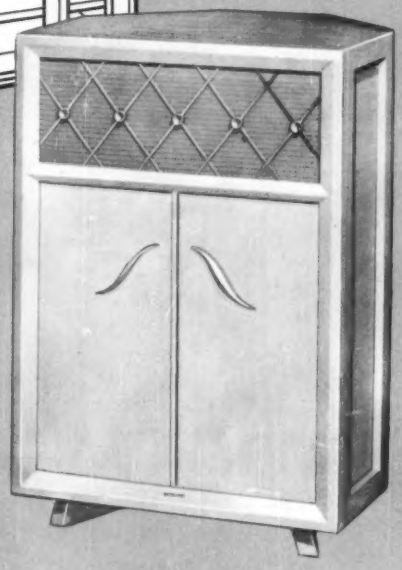
This is the response curve of an Electro-Voice Centurion indirect radiator folded corner horn enclosure employing a 4-way speaker system. Note the essential flatness of response.



Arrows in diagram show sound path in an indirect radiator corner enclosure.



Phantom drawing shows mounting positions of speakers in the E-V CENTURION enclosure, typical of this justly famed Electro-Voice design type.



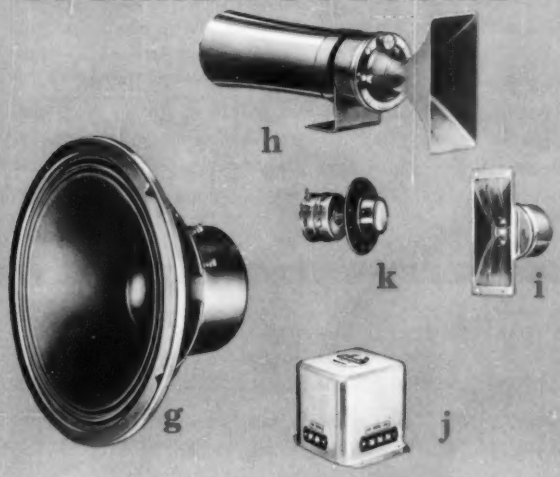
CENTURION IV

Mahogany	$392
Blonde	399
Walnut	399

SENIOR CENTURION IV

Mahogany	$487
Blonde	494
Walnut	494

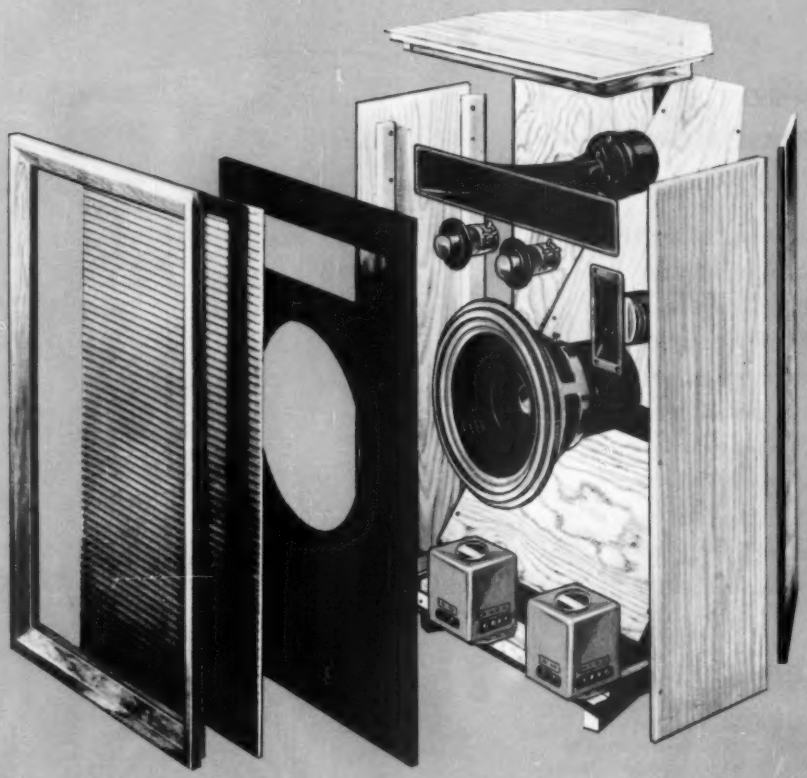
SPEAKER SYSTEMS



This is the 117B indirect radiator speaker system shown in the CENTURION enclosure above. It is an economy 4-way system of unusual performance and high value (**g**) 15BWK "K" type low-frequency driver for bass reproduction; (**h**) MT30B coaxial mid-bass and treble driver-horn assembly; (**i**) T35B very-high-frequency driver for smooth reproduction of the highs; (**j**) X36 crossover; (**k**) two AT37 level controls plus wiring harness and complete instructions including enclosure construction details. Electronic crossovers are at 300 and 3500 cps and there is an acoustic crossover at 1000 cps. Complete, Net $151.

Also shown are some of the components included in the deluxe 105E system of the same type. This deluxe system substitutes a high-efficiency 15WK LF driver for the 15BWK bass reproducer shown and also includes MT30 mid-bass horn assembly and a new T350 VHF driver, an Ultra-Sonax model which has a frequency response of 2kc to 21 kc, ±2db. The deluxe 105E system complete, Net $245.

FOR HI-FI ON A BUDGET, FOLLOW THE ELECTRO-VOICE BUILDING BLOCK PLAN



Start with your basic speaker and improve your compatible E-V high-fidelity system one economical step at a time by adding Electro-Voice Speaker Building Blocks.

Here, we've started with an SP12—12-inch coaxial driver. Later, you add BB2—a T35 very-high-frequency driver, X36 crossover and AT37 level control with wiring harness. BB2, Net $50. Still later, augment with the BB4—to smooth and disperse treble range, it includes T25A treble driver, with 8HD horn, a second crossover—800-cps X8—and a second AT37 level control with wiring harness. BB4, Net $114.

Build Your Own E-V Speaker Enclosure with a Pre-Cut, Pre-Cleated *'Do-It-Yourself'* Kit

There's no thrill like building your own speaker enclosure! Economize on your hi-fi system without sacrificing quality by assembling an E-V knock down kit of Korina plywood. Korina is of highest quality, naturally light in color, harder than mahogany, allows finishing to match any shade. There are seven models to choose from.

Shown dis-assembled is E-V's KD6 kit. Assemble it and you have a duplicate of our factory-built ARISTOCRAT enclosure of folded horn corner design for use with 12-inch drivers or separate multiway systems. KD6, Net $39.

Printed in U.

For all the facts about Electro-Voice 'Listeneered' high-fidelity components, see your distributor and write for complete details.

Electro-Voice®

ELECTRO-VOICE, INC. BUCHANAN, MICHIGAN

Export: 13 East 40th Street, New York 16, U.S.A. Cables: ARLAB

Two TV Programs on One Channel

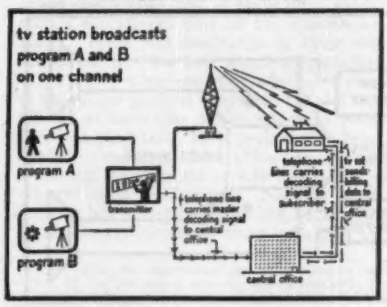
New approach to TV broadcasting techniques may double channel facilities.

A NEW television broadcasting technique that might provide an additional program on each of the TV channels now in use was announced by *Blonder-Tongue Laboratories, Inc.* of Newark, N. J. The company has recently presented its plan to the FCC.

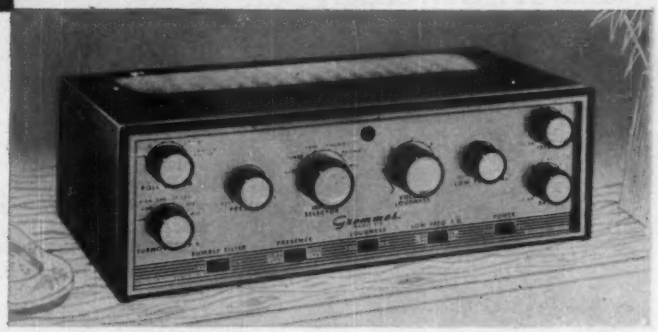
The new method, called Bi-Tran, requires modification of present TV station equipment to enable two programs to be transmitted simultaneously on the same channel. Channel 2, for example, could be designated 2A and 2B; channel 4 could be designated 4A and 4B, etc. The doubling of facilities is accomplished by a special multiplexing process that allows two different pictures to be produced within the same channel width. A series of positive or negative signals enable picture A or picture B to be visible on the TV screen while the other picture is canceled.

The Bi-Tran system may also be applied to pay-TV programming. In this case the primary free program would be received normally by the TV receiver. The alternate program, however, would only become visible and audible by the addition of coded electronic signals. These coding and decoding signals would be carried *via* existing telephone wires in the home, without disturbing regular telephone service. The viewer could switch to the B portion of the channel, thereby selecting a pay-TV program. The decoding signals would be brought to the set and at the same time information would be transmitted back to the telephone central office, indicating the program selected. -30-

The Bi-Tran approach to subscription TV.

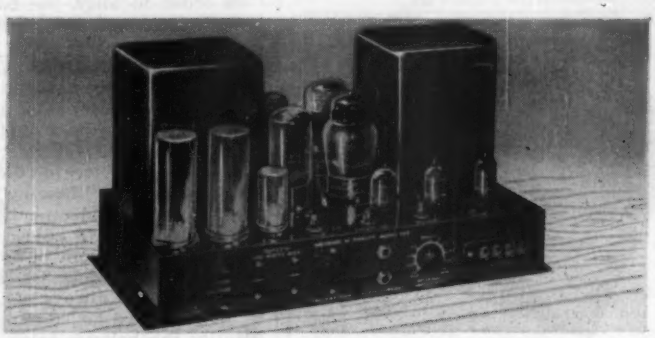

tv station broadcasts program A and B on one channel
program A
program B
transmitter
telephone line carries master decoding signal to central office
telephone lines carries decoding signal to subscriber
for ad sends billing data to central office
central office

the premiere combination for superb fidelity



THE Grommes 212

New deluxe Equalizer Pre-amplifier Control Center designed for those who want the ultimate in high fidelity. Self powered with DC filaments for use with any high quality basic power amplifier. Now, extreme flexibility can be yours with 13 front panel controls. Check these exclusive features: 6 position separate turnover and roll-off record compensators, calibrated bass and treble controls with true flat positions, presence control, low frequency balance control for boosting the lower bass range, feedback around each stage, and 8 inputs which include 2 phono channels and equalized tape head input. The 212 together with the Grommes 260 basic amplifier make the finest combination obtainable. Frequency Response: ±0.1DB, 10 to 20,000 CPS. Distortion: .05% harmonic and 0.1% intermodulation at 10V. output. Finish: Charcoal Gray and Brass. For tabletop or cabinet installation. **Net** **129.50**



THE Grommes 260A

New 60 Watt Hi-Fi Basic Amplifier designed for superb fidelity with far more than ample reserve power to meet every demand without strain or distortion. New advanced circuitry with stability built around 6550 output stage gives performance far superior to ordinary power amplifiers. Circuit features cascode first stage direct coupled to cathode coupled phase inverter; regulated screen and bias voltage supply. Distortion: 0.1% harmonic and 0.2% intermodulation at 30 watts (all distortions under 0.1% at 20 watt level or less). Frequency Response: ± .5DB. 5 to 50,000 CPS (Attenuated beyond 100,000 CPS). Power Response: ± .5DB. 20 to 20,000 CPS. at 60 watts. Premier fidelity assured when combined with the Grommes 212. Net **159.50**

Ask your Hi-Fi dealer for a demonstration or write for complete details to —

Grommes • Div. of Precision Electronics, Inc., Dept. R-12, 9101 King St., Franklin Park, Illinois

Send me new free brochure "High Fidelity by Grommes"

Name_____

Street_____

City_____ Zone_____ State_____

distributor and write for complete details.

Export: 13 East 40th Street, New York 16, U.S.A. Cables: ARLAB

NEW

FAIRCHILD E/D

ELECTRONICALLY

CONTROLLED AND

SPEED-REGULATED

HIGH FIDELITY

TURNTABLE

•

surpasses

all industry

performance

standards

See it at your Fairchild dealer or write for the complete story

Fairchild Recording Equipment Co.
10-40 45th Avenue, L. I. C. 1, N. Y.

Please send me complete details about the new Fairchild E/D electronic turntable.

NAME.....

ADDRESS.....

CITY.....

ZONE.....STATE.....

Stereo Balance Control

(Continued from page 43)

tain an input level control which can be used for this purpose. If not, a potentiometer can be substituted for the power amplifier's input grid resistor, as shown in Fig. 4.

Although the regrouping of control unit—power amplifier—speaker combinations may often achieve good balance between the two channels of the stereo system, this can happen at the expense of other desiderata. For example, the 50-watt amplifier, the more sensitive control unit, and the 8% efficient speaker may be superior components forming the principal audio system of the home. The other equipment may simply be a spare sound system formed in part or total from the remnants of earlier days. In this case, changing the combination of system elements would not seem to be a very practical solution, particularly since most persons still do most of their listening to monaural sources.

Aligning Balance Control

It is to be assumed that when a set of master gain and balance controls is installed in a stereo system, all other gain controls in the system will be set at maximum position. It would be difficult to return to any other setting of such gain controls with the desired degree of exactness.

In order to align the balance control, that is, obtain equal output from each speaker system when the control is at a clearly identified point about mid-range, a fairly simple procedure is both desirable and feasible. The procedure should be a simple one because from time to time it will be necessary to relocate the point of exact balance due to aging or replacement of tubes and other components. Rather than try to adjust input level controls (on the control or power amplifier) so that a certain point on the balance control always indicates equal output, it may be suitable to simply identify the balance point on the dial after each alignment.

To align the balance of the two channels—so that equal output is obtained at about half-setting of the balance control—one may use a monaural signal source such as phonograph record, tape, or radio broadcast, providing conventional musical material. This source should be fed into both channels. One side of the line going to each speaker should be connected to a double-pole, double-throw switch so that in alternate positions of the switch one speaker or the other is disconnected. This setup is illustrated in Fig. 5. Taking a midway position several feet from the speakers and switching back and forth between speakers one should back down on the input level control (in the control or power amplifier) of the channel which produces the higher output until one hears apparently the same level of sound from each speaker when the balance control is at mid-setting. (It may be necessary to also reduce gain in the weaker channel if there is excessive output at low settings of the master gain control.)

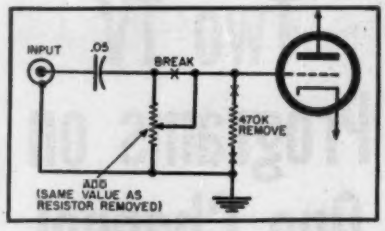
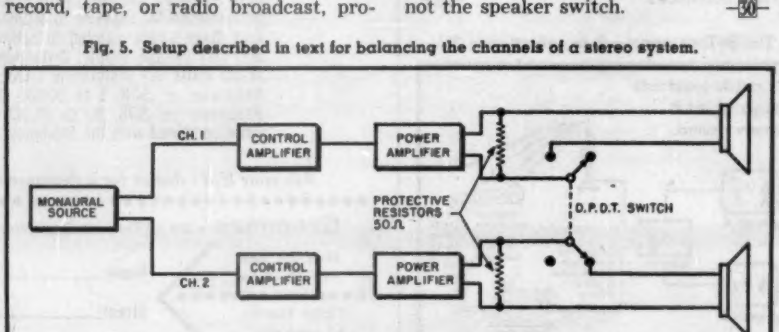


Fig. 4. Installation of an input level potentiometer in a power amplifier.

This procedure will produce balance within 1 db or less, which is quite satisfactory. Use of program material is superior to single tones, such as might be produced by an audio oscillator, test tape, or test record, because it averages the relative response of the speaker systems at various frequencies. In order to protect the output transformers of the power amplifiers against voltage surges when the switch is operated, it is advisable to place 50-ohm resistors across these transformers, as shown in Fig. 5.

It may be added that the procedure shown in Fig. 5 can be simplified a good deal by using as the signal source one of the special test tapes now available on the market, which furnishes the same signal alternately on each channel. This eliminates the speaker switching arrangement as well as the wiring necessary to feed one signal into two channels. By using a regular full-track tape as a source, one can eliminate the wiring task, although not the speaker switch. —30—

Fig. 5. Setup described in text for balancing the channels of a stereo system.



By BERT WHYTE

MY GOSH, it's Christmas time again! Where did that year disappear? To a record reviewer it seems as if we just manage to wade through the holiday flood of recordings only to find that the deluge has started all over again! I never cease to wonder at the nigh incredible proliferation of the record industry. Year after year, the record catalogues bulge ever greater with new recordings and one begins to wonder if a saturation point will ever be reached. It is evidently a long way off and as each Christmas thousands of people are gifted with phonographs, the market for recordings continues to broaden. Another factor is that many people who formerly had no interest in classical music acquire an appreciation of it through ownership of a good hi-fi system. And thus the market still further expands. Recordings are literally the ideal Christmas gift, even for the "man who has everything." No one ever seems to have enough recordings, be he rich or poor. If among your family and friends are known hi-fi enthusiasts, the presentation of recordings is an obvious thing. But even without this background, records are a safe and an appreciated gift. Quite often the gift of records will afford the stimulus the recipient has needed to consider the purchase of hi-fi equipment. Moral of this tale . . . you can't go wrong with records at Christmas time! Herewith some items that may be of interest to someone you know or perhaps as that "wee gift to yourself." (See Xmas Buying Guide on page 64)

To all of you nice readers wherever you are . . . a very Merry Christmas and a Happy and Prosperous New Year!

Here's wishing you all lots of happy hours of disc spinning. We'll keep you posted!

NORMAN VINCENT PEALE
THE COMING OF THE KING
Narration by David Wayne. Music by Don Gillis. Gothic Choir conducted by Ralph Hunter. Ashley Miller, organist. Columbia ML5165. RIAA curve. Price $3.98.

It is not often that any Christmas music reaches the reviewer in time to make the Christmas edition. It's one of those crazy facets of the record business. This is an exception and a highly welcome one. Essentially the record tells the story of the nativity from a text written by America's best-known minister, Norman Vincent Peale. Although couched in simple terms and in simple language, Dr. Peale's text is beautifully written with a magnificent play on the English language. There will inevitably be those who dismiss it as trite and oversentimentalized. What a pity there are some who can't adapt to the proper spirit at Christmas time! David Wayne narrates the simple tale with reverence and good taste, his superb diction beautifully reproduced. Don Gillis has afforded a musical background largelv derivative of oriental music and motifs. Nothing earth-shaking but merely appropriate background for the story. The choir sings quite well and

The opinions expressed in this column are those of the reviewer and do not necessarily reflect the views or opinions of the editors or the publishers of this magazine.

EKTACOM
intercommunication systems

100% AC operation
45 ohm balanced lines
Feedback noise cancellation
Instrument quality components
Intermix masters and remotes
Conference calls
All metal cabinet
Two negative feedback circuits
Printed circuit board
Tubes: EL84, 6CM8, 6X4

For more information on our complete line of intercoms, write for new brochure.

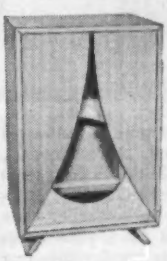
FISHER BERKELEY CORPORATION
4224 Holden Street Emeryville 8, California

HI-FI ACCESSORIES BY
Dynamic ELECTRONICS
FOR BETTER RESULTS

SPEAKER SELECTOR

DeLuxe unit to couple up to 3 speakers from 1 audio output. Maximum flexibility selects any of the 3 speakers individually or any combination of speakers as desired.
• 3 separate toggle selector switches
Model DS80 . . . List $7.50
THERE IS A DYNAMIC ACCESSORY FOR ALMOST EVERY NEED . . . SOLD ON A MONEY BACK GUARANTEE!
At leading distributors everywhere. Full line catalog on request!
Manufactured By
DYNAMIC ELECTRONICS-NEW YORK, INC.
Forest Hills, Long Island, N. Y.

A BOX IS NOT A MUSICAL INSTRUMENT



No skilled musical instrument maker, including even those in aboriginal tribes, has ever found a rectangular box satisfactory. IN SPITE OF THIS, today many HI-FI speaker systems proclaim the ultimate in high fidelity, yet they employ nothing more than the most elementary boxes to perform the complicated function of transforming the vibrations of the loudspeaker into sound.

In the KARLSON ENCLOSURES, specially curved internal and external structures are used to provide you with the highest performance capabilities available in the industry today. Actually the Karlson enclosure is one of the most fabulous musical instruments ever created and is capable of reproducing every sound from a baby's breath to the mighty roar of thunder. After long and rigorous tests, we know definitely that the Karlson Enclosures can outperform all other units now available on the market at any price.

Despite their fantastic performance characteristics these units are available to you in 20 different models in KIT, UNFINISHED AND FINISHED FORMS, at prices you can afford, ranging from $18.60 to $174.00.

SEND FOR OUR COMPLETE CATALOG TODAY AND LEARN HOW THE KARLSON ENCLOSURE CAN BE FITTED TO YOUR SPECIFIC NEEDS.

KARLSON ASSOCIATES, INC., Dept RTNS
1610 Keck Road
Brooklyn 29, New York
Please send catalog:
Name .....
Address .....
City .....State.....

MENDELSSOHN

EUGENE LIST
makes his tape recordings on

irish BRAND ferro-sheen recording tape.

That's not the reason why you should use

irish BRAND ferro-sheen recording tape.

Here's why you should use

irish BRAND ferro-sheen recording tape:

It's the best-engineered tape in the world ...gives you better highs...better lows... better sound all around! Saves your tape recorder, too—because the **irish** FERRO-SHEEN process results in smoother tape ...tape that can't sand down your magnetic heads or shed oxide powder into your machine. Price? Same as ordinary tape!

Available wherever quality tape is sold.
ORRadio Industries, Inc., Opelika, Alabama
Export: Morhan Exporting Corp., New York, N. Y. Canada: Atlas Radio Corp., Ltd., Toronto, Ontario

the organ accompaniment is cleanly reproduced. This is ideal for the kiddies on Christmas Eve.

PROKOFIEV
PETER AND THE WOLF
BRITTEN
YOUNG PERSON'S GUIDE TO THE ORCHESTRA
Philadelphia Orchestra conducted by Eugene Ormandy. Cyril Ritchard narrates the Prokofiev piece. Columbia ML5183. RIAA curve. Price $3.98.

Prokofiev's perennial favorite receives here what is among the best, if not *the* best recording yet. Cyril Ritchard's wonderfully smooth, well modulated voice, is ideal for the work and he does a first-class job without the usual mannerisms which beset the narrators in so many other versions. Ormandy and the Philadelphia respond graciously and their playing is a lovely thing to hear. The "Guide" is a very slick job by Ormandy, but a little lacking in warmth. This "Guide" is really more of a revelation of the virtuoso talents of the members of the Philadelphia as Britten's work makes its way through the orchestra. A breathtaking demonstration of orchestral precision, lushness, and tonal color. The bright clean sound limns every instrument with a bit too much reverb my only quibble.

BRITTEN
THE PRINCE OF THE PAGODAS (BALLET)
Orchestra of the Royal Opera House, Covent Gardens, conducted by Benjamin Britten. London LL1690/1. Two 12" records. RIAA curve. Price $7.96.

Here is the prolific Britten once again, this time with a full length ballet. The critics have blasted this work as overlong and full of cliches. It is admittedly a bit on the long side, but as for cliche . . . I wouldn't say it was rife with them at all. As a matter of fact there is considerable invention of the jazzy colorfully orchestrated type of music with which Britten has long been identified. Except for some of the most hide-bound ivory tower musicologists, most people will find this appealing music and sound enthusiasts will revel in a feast of transients, percussives in a hi-fi dilly.

Here are some choice *new* recordings that will make fine Christmas gifts:

SONGS OF THE OLD WEST
Ed McCurdy, singer. Elektra EKL112. Price $3.98.

About the best and cleanest recording of popular Western favorites.

RIMSKY-KORSAKOV
SCHEHERAZADE
Berlin Radio Symphony Orchestra conducted by Ferenc Fricsay. Decca DL9908. Price $3.98.

A lush big hall sound and solid performance values make this among the top recordings of this work in the catalogue.

SOUND OF STEAM RAILROADING
O. Winston Link Productions, 58 E. 34th Street, New York, N. Y.

This is the steam railroad record to end them all! The recording was cut on Mr. Jerry Minter's revolutionary *"HydroFeed"* recording lathe and there are transients on this record you just won't believe! Play this on a big speaker system and the chugs, blasts, and whistles, the clinks and the clangs will floor you! One of the most severe tests for pickup cartridge compliance and tracking ability imaginable. The realism on this record is such that even thinking about a stereo version of it is terrifying.

Significantly BETTER

ULTRA-LINEAR II*
Amplifier

Significantly better—of course—because it features a new feedback system in the proven Acro-Developed, Ultra-Linear circuit that sets a new standard of stability in amplifier performance.

Significantly better—the heart of the 60 watt Ultra-Linear II amplifier is the Acrosound TO-600 output transformer which provides a degree of feedback unaffected by the impedance of the speaker system.

Significantly better—the Ultra-Linear II amplifier is supplied in kit form with all critical wiring preassembled on a rugged printed circuit board . . simple construction requires only 2 hours' assembly time.

Significantly better in every way:

RATED POWER OUTPUT—60 watts
IM DISTORTION—less than 1% at 60 watts
HARMONIC DISTORTION—Less than 1% between 20CPS and 20 KC at power output within 1 DB of 60 watts
SENSITIVITY—1.8 volts RMS for 60 watts output
OUTPUT IMPEDANCE—4, 8, 16 ohms
TUBES—2-EL34,1-GZ34,1-12AX7,1-12AU7
DAMPING FACTOR—Variable from 0.5 to 10.
HUM—90 DB. below rated output
SIZE—7" x 15" x 8" high
WEIGHT—30 lbs.
Price $79.50 complete with all components. $109.50 wired and assembled (slightly higher in West)

* Patent Pending

Please send literature on illustrated Ultra-Linear II Amplifier

Name .....
Address .....
City ..... State .....

ACRO PRODUCTS COMPANY
369 SHURS LANE, PHILADELPHIA 28, PA.

original, which when dubbed to stand-

MENDELSSOHN
VIOLIN CONCERTO IN E MINOR
BRUCH
VIOLIN CONCERTO #1 IN G MINOR

London Symphony Orchestra conducted by Pierino Gamba. Ruggiero Ricci, violinist. London LL1684. Price $3.98.

Bright new versions of two concert hall favorites. Ricci is most persuasive and assured and he receives what is probably the best sound among the many other recordings.

LUKAS FOSS
PIANO CONCERTO #2
WAXMAN
SINFONIETTA FOR STRINGS AND TYMPANI

Los Angeles Festival Orchestra conducted by Franz Waxman. Lukas Foss, pianist. Decca 9889. Price $3.98.

A real sleeper this . . . a fine modern American concerto, and an interesting string work. Very pungent scoring here full of hi-fi bing and bang. Not too atonal. This should appeal to your more venturesome musical friends. Superb sound throughout. —30—

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					4	5
						12
						19
						26

CALENDAR of EVENTS

DECEMBER 1-6
The American Society of Mechanical Engineers. Statler and McAlpin Hotels, New York, N. Y. Information regarding the program available from ASME meetings department, 29 W. 39th St., New York 18, N. Y.

DECEMBER 3-4
Joint Symposium on "Human Factors in Systems Engineering." Sponsored by IRE (Philadelphia Section and the Professional Group on Military Electronics) and the Human Factors Society of America. Penn-Sherwood Hotel, Philadelphia, Pa. Mail registration to Conrad Fowler, American Electronic Labs., 121 N. 7th St., Philadelphia, Pa.

DECEMBER 4, 5
PGVC Annual Meeting. Statler Hotel, Washington, D. C. Information regarding program available from Grant Woodside, Motorola Inc., 2309 Calvert St., N.W., Washington 8, D. C.

DECEMBER 9-13
Eastern Joint Computer Conference. Sponsored by AIEE, ACM, and IRE. Sheraton Park Hotel, Washington, D. C. Further information from Dr. S. N. Alexander, National Bureau of Standards, Washington 25, D. C.

DECEMBER 18, 19
Conference on Maintainability of Electronic Equipment. Sponsored by EIA (formerly RETMA) University of Southern California, Los Angeles, Calif.

JANUARY 6-8, 1958
Fourth National Symposium on Reliability & Quality Control. Sponsored by IRE and AIEE. Statler Hotel, Washington, D. C. For programming information, contact C. M. Ryerson, RCA, Building 10-6, Camden 2, N. J.

NEW SONOTONE CA-12 12" CO-AXIAL LOUDSPEAKER

40-14,000 cycles—elliptical cone tweeter—complete dividing network. And the price...$19.50. That's right, $19.50. Yet it out-performs speakers selling at three times the price. Interested? Listen to the CA-12 and be convinced.

Ask your dealer for a demonstration, or send your name and address for full details.

Electronic Applications Division

SONOTONE® CORPORATION

ELMSFORD, N. Y.

SONOTONE CORPORATION, Dept. LN-127, Elmsford, N. Y.

NAME_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Sound on Tape

By BERT WHYTE

SOME wives have trouble finding the "right" gift for hubby whenever Christmas rolls around. No such problem exists for the gal who is married to a tape hound, especially the stereophonic variety. Almost limitless possibilities for gifting him with the "right" thing exist in this field. If hubby hasn't "gone stereo," the little woman can consider such delectable items as stereo tape decks, stereo conversion head kits, another amplifier and preamp. or a new single-chassis stereo amplifier. There is always the presentation of another speaker, or even a matched pair. For the more affluent there is the stereo recorder and stereo tuner for AM-FM stereo or multiplex stereo recording off-the-air. One could go on and on, but there is one item no husband, be he poor or prosperous, ever has enough of and that is stereo tape recordings. Unhappily there is little need for me to point out that stereo recordings are on the expensive side and for most people the acquisition of a stereo library is a slow and costly process. So at Christmas, when financial caution is often thrown to the wind, this is the time to plant the stereo bee in the missy's bonnet! For the benefit of the wives of RADIO & TV NEWS readers who may have this column thrust at them as a subtle (?) hint, this month's reviews will be shorter so there will be more of them to aid in gift-giving.

At this time I want to thank you, dear readers, for your many kind letters in regard to this column. Such encouragement makes a guy feel pretty good. I hope that in the coming year I will be of help to you in your tape activities, with an expanded column for broader coverage. And now a very Merry Christmas and the happiest New Year to all of you, everywhere!

(Unless otherwise noted all tapes are stacked stereo on 7 inch reels at 7½ inches tape speed and all employ NARTB tape playback equalization.)

TCHAIKOVSKY
THE NUTCRACKER BALLET (COMPLETE)
Philharmonic Symphony Orchestra of London conducted by Artur Rodzinski. Sonotape SWB9003,9004 (2 reels). Price $15.95 each reel.

Who says stereo isn't coming of age? It took many years for a complete "Nutcracker" to appear on discs, and here in a very brief span of time the work is appearing in stereo on tape. *Sonotape* was no doubt encouraged by the good reception afforded its earlier release of a "concert" version of the "Nutcracker" and decided to make the complete ballet available. Granted that the total outlay of money for this is rather staggering, it is one of the few works popular enough to sell at this price. And if this happens to be one of your favorites I can assure you that it is worth the money. Rodzinski has a peculiar flair for this music and affords it a deft, very polished and spirited reading. There is some outstanding stereo sound to be heard here. The work abounds in writing that lends itself to spectacular exploitation in stereo. This is not to say that the engineers have overstepped the bounds of good taste. Man, wait until you hear the "Battle of the Mouse-King" section in the full-throated glory of stereo. It is really a sonic knockout! This is big, large hall sound with reverb calculated to lend maximum presence without smearing orchestral detail. All orchestral elements are cleanly reproduced, always distinct and articulate. With the wide frequency and dynamic range, good directionality, and general excellence of the stereo effect, this makes the "Nutcracker" one of the best tapes yet produced by *Sonotape*.

BIZET
CARMEN SUITE
L'ARLESIENNE SUITE #1
Detroit Symphony Orchestra conducted by Paul Paray. Mercury MDS5-3. Price $12.95.

Here is another of the *Mercury* stereo-stunners! This music has a very universal appeal and when it can be heard with such stereo magnificence, the totality of effect on most people is astonishing. I have played this tape for many people, a good percentage of whom were not conversant either with hi-fi or with music. These people were literally dumb-struck with what they had heard. They were totally unaware such reproduction was possible and most found it pretty hard to believe. This is, of course, not an unusual reaction to stereo, and outstanding tapes of companies other than *Mercury* have elicited similar responses. The significant thing about this tape was that after the most brief explanation of how stereo worked, the majority of the listeners could easily discern direction and would excitedly call attention to the "tympani in the center." And they were quite right, because this was another three-track original, which when dubbed to standard two-channel had the central channel "ghosted" in between. This process, plus such things as hall acoustics and the nature of the score itself (in the "Carmen Suite") combined to give as close an approximation to the three-channel master as anything I have heard. This stereo did indeed present an almost unbroken sonic front spread before the listener. Directionality was pronounced from the side channels and from the "ghost" channel suspended, as it were, between the speakers. Hall acoustics gave a good deal of air around the orchestra, and this was calculated into the mike positioning so that the final result was the quasi-three-channel sound with tremendous detail and a very forward, almost solid projection of the music. All orchestral elements were sharply and cleanly reproduced, with a nice open sonority to the strings, a mellow resonance to the woodwind, a bright, brazen, almost palpable blare from trumpet and trombone, and percussion, especially the aforementioned tympani and bass drum were of imposing weight and impact. This is one of the few recordings of "Carmen Suite" where the tambourine can be heard against the other instrumentation and in natural balance as occurs in live performances. A word of warning again about dynamic range. No compression has been used and if you are not careful, what seems like a reasonable level will suddenly blow you through the wall! The "L'Arlesienne #1" is treated in similar fashion and has the same exemplary sound qualities. The performances under Paray are very brisk and assured, just a shade or two off what could reasonably be called definitive. This then is a fabulous tape and would seem to represent the present limit of refinement of the three-channel master, two-channel ghosted center dub technique. A comparison of this method versus the English M/S technique at this time would not be very valid due to lack of playback material and unfamiliarity with M/S playback techniques. There are undoubted merits and advantages to both systems, and it is to be hoped that whatever disadvantages exist will soon be resolved. In the meanwhile don't fail to hear this tape . . . it's a real whing-ding!

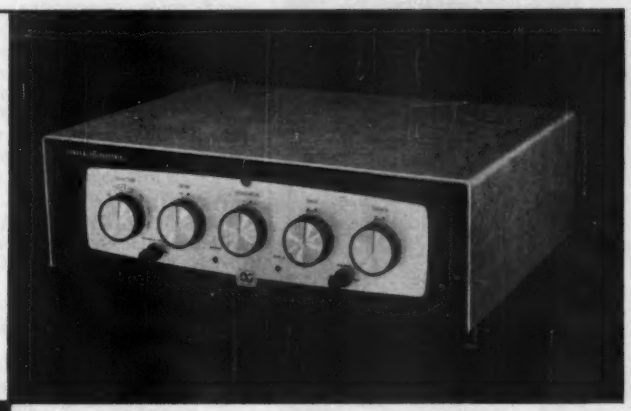
ROSSINI-RESPHIGHI
LA BOUTIQUE FANTASQUE
Boston Pops Orchestra conducted by Arthur Fiedler. Victor CCS-53. Price $10.95.

Fiedler in fine fettle . . that about qualifies this recording as noteworthy. When the Boston Pops' maestro has material he obviously likes, he conducts it with great relish and fine high spirits. This gay and spritely music is the sort of vehicle that highlights the stunning virtuosity of the Boston orchestra. Fiedler's light-handed performance is wonderfully alive in the bloom of stereo. Hall reverb is somewhat enhanced here over some other Boston stereo recordings. However, the "bigness" is not overdone and is reproduced with startling clarity. The

POWER TO SPARE FOR CRISP, CLEAR REPRODUCTION! •

new G-E pa-20

20-WATT AMPLIFIER AND PREAMPLIFIER IN ONE HANDSOME UNIT



SPECIFICATIONS

Power Output—20 watts

Frequency Response—20 through 20,000 cycles 1 db

Harmonic Distortion—1% nominal

Intermodulation Distortion — 2.4% at full 20 watts 60/7000 cycles 4:1

Hum and Noise—55 db below 20 watts on phono input 75 db below 20 watts on high level inputs

Phono Input Sensitivity—5 to 6 millivolts at full output

Phono Equalization—accurate within 1¾ db

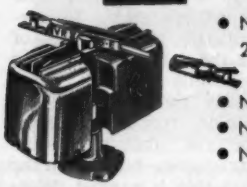
General Electric's new 20-watt Amplifier-Preamplifier brings you the smooth, clean response you demand in your High Fidelity sound system. It offers five separate inputs, four outputs and seven different controls to satisfy every home audio need.

To achieve a very sharp low-frequency cutoff of 12 db per octave below 40 cycles, the new PA-20 incorporates an unusual L-C tuned circuit in its rumble filter. Rumble and sub-audio frequencies are filtered out with no appreciable effect on bass response.

The compact, modern design of the PA-20 fits easily on a bookshelf, or it can be divided for separate mounting of preamplifier and power units. Ask for a demonstration of the new General Electric PA-20 at your Hi-Fi dealer soon.

BE SURE TO SEE AND HEAR THESE OTHER G-E HIGH FIDELITY COMPONENTS:

NEW **G-E VR II magnetic cartridge**



- New full-range reproduction . . . 20 through 20,000 cycles
- Instant Clip-In-Tip Stylus
- New 4-gram tracking force
- New electrostatic shielding
- New lightweight construction

High Fidelity Components Cabinet

Designed for custom mounting of amplifier, preamplifier, tuner, changer or turntable, and accessories.

"Distributed Port" Speaker Enclosure

G.E.'s "Distributed Port" principle provides effective damping and loading at low frequencies. In mahogany, cherry or blond.

12" GOLDEN CO-AX Speaker

- 12" woofer, 2¾" tweeter
- Built-in crossover network
- 25-watt power rating

8" Speaker Enclosure

Features "Distributed Port" design for outstanding power handling ability and consistently smooth response.

G-E "Baton" Tone Arms Strong, lightweight aluminum with sealed ball-bearing mountings. "Pivot-tilt" head.

GENERAL ELECTRIC

Specialty Electronic Components Dept.
Section HFRT12, West Genesee Street
Auburn, N. Y.

Please send me more information on these components:

Name_____

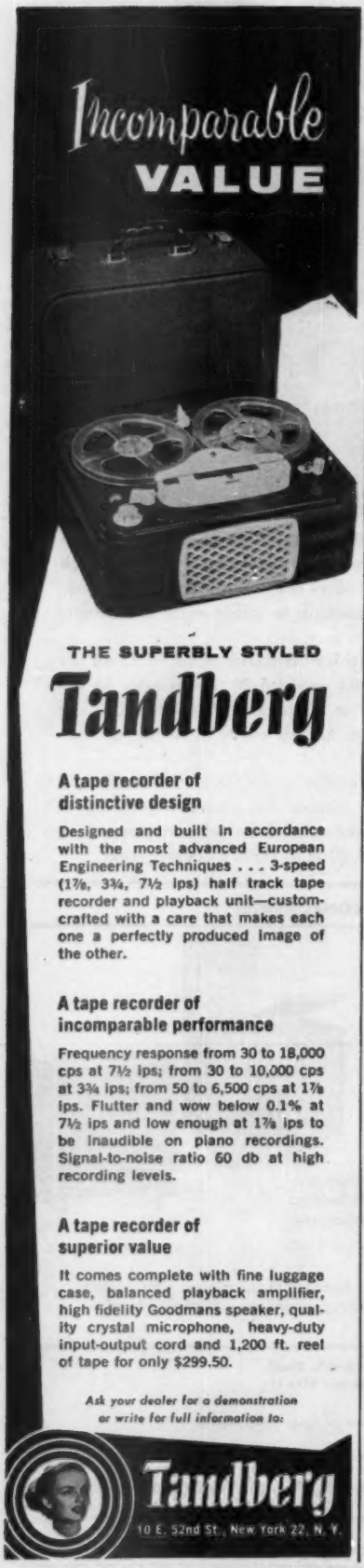
Address_____

City_____ Zone_____ State_____

wah-wah trombones, and the atonal horns, etc. stand revealed as never before. In the delightful parody on

never blurred or out of acoustic focus. The over-all effect is grandiose . . . a great outpouring of sound that is quite

RONETTE


Incomparable
VALUE
THE SUPERBLY STYLED
Tandberg
A tape recorder of distinctive design
Designed and built in accordance with the most advanced European Engineering Techniques . . . 3-speed (1⅞, 3¾, 7½ ips) half track tape recorder and playback unit—custom-crafted with a care that makes each one a perfectly produced image of the other.
A tape recorder of incomparable performance
Frequency response from 30 to 18,000 cps at 7½ ips; from 30 to 10,000 cps at 3¾ ips; from 50 to 6,500 cps at 1⅞ ips. Flutter and wow below 0.1% at 7½ ips and low enough at 1⅞ ips to be inaudible on piano recordings. Signal-to-noise ratio 60 db at high recording levels.
A tape recorder of superior value
It comes complete with fine luggage case, balanced playback amplifier, high fidelity Goodmans speaker, quality crystal microphone, heavy-duty input-output cord and 1,200 ft. reel of tape for only $299.50.
Ask your dealer for a demonstration or write for full information to:
Tandberg
10 E. 52nd St., New York 22, N. Y.

Boston stereo recordings. However, the "bigness" is not overdone and in fact complements rather nicely the sharply detailed close-up sound of the strings, woodwind, and brass. Directionality was excellent in this recording and aided in the illusion of a very broad sonic perspective. The three-channel technique employed in the recording all but completely eliminated the "hole-in-the-middle" effect. With the added plus of wide dynamics and good signal-to-noise ratio, this tape is a splendid addition to the stereo catalogue or to anyone's stereo library.

PROKOFIEV
CLASSICAL SYMPHONY #1
Philharmonia Orchestra conducted by Nicolai Malko. Victor ACS-37. Price $6.95.

Assiduous tape worms in search of stereo material have noted this recording and many others as being issued by *HMV* in England. Outside of a few people who either picked up the tape themselves in England, or had friends bring home a copy, the tape has remained an unknown quantity. It is ironic now that *HMV* and *Victor* are ending their many years of association that this tape and a few others are finally being released in this country. There have been many conflicting reports about the quality of the English stereo . . . some said good and others couldn't stand the stuff. A probable factor in this wide divergence of opinion is the method of stereo recording which the English seem to favor. A method known as "M/S" is used wherein a double microphone is hung above the orchestra as in a single mike monaural pickup. The "M" mike is a highly directional cardioid type which picks up the direct sound of the orchestra. The "S" mike has a "figure-eight" pattern which is used to pick up the secondary sound reflected from the walls of the hall. This method is supposed to cut out a little of the directionality in return for which the "hole-in-the-middle" is eliminated, affording a much broader area of stereo perception. Another advantage is that the one recording can furnish both a stereo and monaural master. Reportedly the optimum stereo effect is produced when the M portion is heard on a central speaker and the S signal is fed through two speakers located to the left and right of the center channel. In other words, this method approximates three-channel stereo. I am not fully conversant with all the techniques involved, but I intend to follow this up and do a little experimenting. Thus far I have heard this tape only in the normal American-style two-channel playback. New or superior method or not . . . this is a beautiful sounding tape. Directionality appeared to be somewhat less than is usual, but was still quite apparent and still a useful augmentation. The area of stereo perception was indeed broad and one was very much aware of the "bigness" of the hall due to the reverb. The "Classical Symphony" is very demanding of the strings and these were reproduced with startling clarity. The tape was exceptionally clean and the sharp incisive attacks of the strings came through without audible distortion. Malko affords the work a sympathetic performance, just a shade too hurried for my taste, and the Philharmonia plays beautifully. The work is as fresh and vital as ever and as heard in stereo becomes a newly rewarding musical experience.

BUXTEHUDE
ORGAN MUSIC
Alf Linder, organist, playing instrument at Varfrukyrka at Skanninge, Sweden. Sonotape SWB8022. Price $12.95.

In addition to the notable series of Bach organ recordings with Carl Weinrich, *Sonotape* has been busily engaged in recording the complete organ works of Buxtehude. This tape is one of the first in the series and contains such items as "Prelude and Fugue in C Major," "Toccata in D Minor," a chorale fantasy, and a chorale prelude. The organist is Alf Linder, an acknowledged authority on the music of Buxtehude. Mr. Linder displays his skill with clean straightforward playing, devoid of fussy mannerisms. His taste in registrations is admirable for its harmonic balances. As in previous *Sonotape* recordings of the Skanninge organ, this is characterized by ultra-clean sound. The middle and upper registers of the organ are very crisp and articulate, the pedal organ has imposing weight for a baroque instrument, and with all this, is well defined. The stereo considerably heightens the presence already afforded by the superb acoustics of this church. Directionality is not too pronounced here nor is it so important in this type of music. The main benefit of stereo here is its ability to limn every note with sharp detail and at the same time afford a cathedral "liveness" to the over-all sound. The music itself is an interesting precursor of some of the later output of Bach. There is the familiar glittering toccata, the lovely fantasia free-forms, the sturdy themes. Good dynamics and wide frequency range throughout the tape, some impressive pedal for low frequency buffs. For the organ enthusiast this is a most delectable item.

This tape will also afford the audio enthusiast a means of demonstrating just what his system will do on a wide range organ recording.

IBERT
DIVERTISSEMENT
Boston Pops Orchestra conducted by Arthur Fiedler. Victor ACS-54. Price $6.95.

This is the first stereo version of Ibert's saucy, impudent, "Divertissement." This is choice material for stereo, there being much interplay between various choirs in the orchestra. Good directionality highlights this interplay and contributes heavily to the stereo illusion. In the clear light of stereo all the raucous devices, the

wah-wah trombones, and the atonal horns, etc. stand revealed as never before. In the delightful parody on the "Wedding March" and in most of the other sections of the work, the stereo affords a degree of delineation impossible to achieve on a disc. Once again *Victor* has come up with that judicious blend of hall reverb and orchestral detail that makes for maximum presence. An exciting little tape and great fun . . . all wives should hear Ibert's idea of the "Wedding March" at least once in their lives!

SAINT-SAENS
SYMPHONY #3 (ORGAN SYMPHONY)
Vienna Philharmusica Symphony Orchestra conducted by Hans Swarowsky. Urania UST1201. Price $11.95.

As I noted in the disc review of this recording, it is one of the better versions of this stimulating work. This stereo version lends further support to this evaluation. The outstanding attribute of this recording is the acoustic perspective. Rarely have I heard such a huge encompassing type of sound, obviously recorded in a great hall, but through the magic of stereo remaining sharp in detail and completely articulate. Really quite an astonishing effect. Directionality was not as apparent as I had imagined it would be with this score, but was adequate. The organ at last finds room to breathe and be heard, thanks to the stereo sunlight. It rumbles and growls way down in the sub-basement, but is never blurred or out of acoustic focus. The over-all effect is grandiose . . . a great outpouring of sound that is quite thrilling. Those musical sophisticates who think this work is somewhat trite should hear this tape in stereo through a pair of big speakers!

TCHAIKOVSKY
1812 OVERTURE
Vienna State Opera Orchestra conducted by Hermann Scherchen. Sonotape SWB7002. Price $6.95.

Sonotape has just launched a new group of stereo tapes known as the "7000 Series." These are for the most part recordings of shorter works, such as the "1812 Overture." The nice thing about them is the $6.95 price tag, which is certainly a step in the right direction. The selections are all complete and are on regular 7" reels. Packaging is attractive and music annotation is supplied. Scherchen's reading of the "1812" is considerably mannered, but one cannot deny that this is a super-charged, hell-for-leather version. Scherchen pulls out all stops and his extremes of dynamic expression leave one gasping. The stereo aids as fustian a work as this considerably, especially when so many orchestral elements are roaring along together as in the crashing finale. Instead of a somewhat grand blur, the instrumental detail is sharp and clean. Large sounds, large acoustics, and crisp orchestration all wrapped up in the best of stereo add up to an appealing buy. —30—

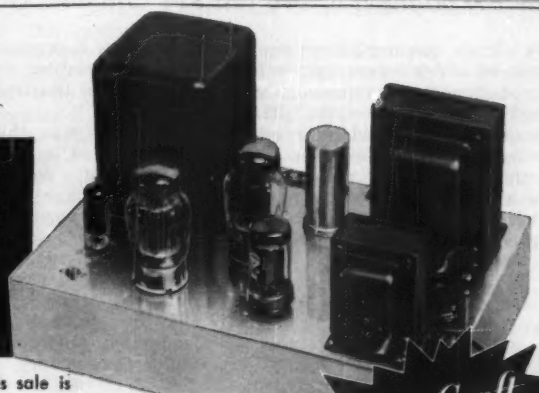
RONETTE
new hi-fi cartridge

tropic powered
No humidity problems
requires no preamp,
however, when used with premap performance exceeds expensive magnetic pickups.

- Response: flat from 30 to 24000 cps
- IM distortion negligible even at very high velocities because of extremely small moving mass.
- Output: .4 volts @ 1 sec/cm.
- Ronette exclusive Stylomatic* design permits quick and positive styli replacement with no tools whatsoever.
- No hum problems—no turntable pull.
- With 1 and 2.5 mil sapphire styli.
- Diamond styli available. *Trade Mark

See your nearest Ronette distributor or write to:
Ronette Acoustical Corp.
190 Earle Avenue · Lynbrook, N.Y.

below manufacturer's cost!
fully guaranteed
60 WATT AMPLIFIER

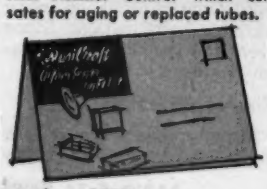


MusiCraft Special

MusiCraft capitalized on a once-in-a-lifetime opportunity. Because this sale is limited, act fast. Look at the price...Check and compare the specifications... Complete satisfaction is assured or your money back.

SPECIFICATIONS
- IM Distortion....Less than 1% @ 60W.
- Harmonic Distortion....Less than 1% 20 cps. to 20,000 cps.
- Frequency Response....±0.5DB, 20 cps. to 20,000 cps.... ±1DB, 7 to 70,000 cps.
- Sensitivity....1.5 volts rms. for 60 watts.
- Damping Factor....choice of 15 or 30 by a switch.
- Hum and Noise Level....85DB below 60W.
- Hum Nullifier Control which compensates for aging or replaced tubes.

FEATURES
- Chrome plated chassis
- Choke filtered power supply
- Octal socket for preamplifier power connection (wired for Heathkit, Dyna-kit and other preamplifiers)
- Fuse receptacle on chassis
- Heavy duty power cord
- Biased filament supply
- Tubes: 2-6550, GZ34, 6BA8A
- Completely assembled, wired, and tested
- Dimensions—9" x 14" x 8" high. Shpg. Wt., 31 lbs.



Mail Orders Filled Promptly
For more high fidelity bargains write for MusiCraft's brochure.

IN FACTORY SEALED CARTONS
manufactured to sell for $169.95
NOW $74.95

MusiCraft 48 East Oak St., Chicago 11, Ill., DElaware 7-4150

being used by all of the major record

ues will vary from one circuit to an-

RIAA Equalization for Early Preamps

View of converted preamp, built on a Vector plug-in socket assembly using a shield can.

By **JOHN F. KEIDEL**
Instructor
Temple University Technical Institute

How to convert your early G-E and other basic preamps to the RIAA curve in less than an hour's time simply by the addition of two resistors and two capacitors.

MANY basic preamplifiers manufactured a few years ago, which included early equalization, can be readily converted to the RIAA equalization standard and returned to active service. The conversion data which this article will provide may also be applied to the basic preamp section of many of the older amplifier-preamp combinations.

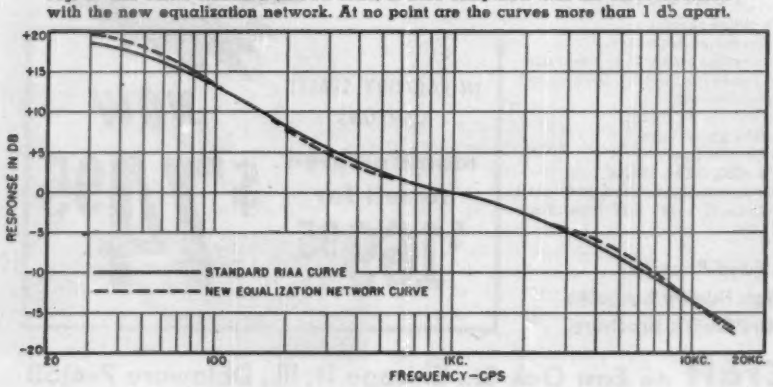
Typical Circuit

Perhaps the most popular of these basic preamps, and one that is typical of any number of the older units, is the famous *G-E* Model UPX-003 or SPX-001 (same as the UPX-003 but without a power supply). Since this *G-E* circuit is representative of a wide variety of similar circuits, it will be used here to illustrate the conversion procedure.

Not only was this particular unit manufactured in quantity but a great number of do-it-yourselfers constructed similar units based on this circuit. The popularity of this preamp was entirely justified since the performance offered set a new standard in the faithful reproduction of sound for that time. After the circuit changes outlined herein have been completed, performance should prove highly satisfactory, even by present-day standards.

Photos show disassembled views of a home-constructed plug-in preamp. The unit was originally wired according to the old *G-E* basic preamp schematic diagram. This version, built on a *Vector* plug-in socket assembly with shielded can, has a "professional" look.

Fig. 1. The RIAA standard (shown solid) is here compared with the curve obtained with the new equalization network. At no point are the curves more than 1 db apart.



Early Equalization

Fixed equalization incorporated in the circuit was designed to suit early recording characteristics. Bass compensation closely conformed to the old *Columbia* LP curve, which had a 500 cps turnover frequency with about 15 db boost at 30 cps. When a *G-E* cartridge was used with the appropriate load resistor, high-frequency correction matched the old AES curve, which had a treble roll-off of 2500 cps with the 12 db down point at 10,000 cps. To provide the old AES roll-off characteristic, the *G-E* variable reluctance cartridge was loaded with a 6800-ohm resistor. Different cartridge load resistors could be selected to produce various other curves. For example, the *Columbia* LP roll-off would result if a 3900-ohm load resistor were used.

Unfortunately, before 1954 no one standard equalization curve had been agreed upon and there were almost as many recording curves as there were record companies. Hence, obtaining optimum playback results from one label disc to another was virtually impossible, unless some provision were made for variable equalization. Since 1954, however, the standard equalization problem has been solved.

RIAA Equalization

The RIAA recording curve is now the accepted standard and is presently

being used by all of the major record companies. Since this new curve represents something in the way of a compromise among earlier ones, many of the older labels respond favorably. The RIAA playback characteristic is shown in Fig. 1. Included with this curve is the actual response pattern of the new equalizer network, which will be discussed later.

The RIAA playback curve has the following characteristics: low-frequency turnover at 500 cps, high-frequency roll-off occurs just above 2100 cps; bass boost raises the response to +18.6 db at 30 cps and the high-frequency attenuation drops it to —13.75 db at 10,000 cps.

Converting the Circuit

Converting the old *G-E*, or similar, circuits should prove to be a very worthwhile and rewarding project. Two capacitors and two resistors are all the components needed to make this alteration.

The schematic of the original SPX-001 circuit is given in Fig. 2A. Fig. 2B shows the converted unit. Note the change in values for R_1 and R_5. A .0033 μfd. capacitor (C_a) should be added in parallel with this new value of R_5 and C_b (.005 μfd.) bridged across C_2 to increase its total value to .015 μfd. The 180,000 ohm resistor (R_6) found in most original circuits should be removed. R_1, a 47,000 ohm resistor, is now used to load the cartridge for flat response. This revised cartridge load should provide a flat frequency response for most magnetic type cartridges. *(Editor's Note: If the new G-E VR-II cartridge is used, R_1 should be 100,000 ohms.)* Roll-off is then obtained by placing C_a in parallel with the revised value of R_5 (22,000 ohms). A list of the new components required accompanies the schematic diagram of Fig. 2. As one can see, the changes required are few, allowing the entire operation to be completed in less than an hour.

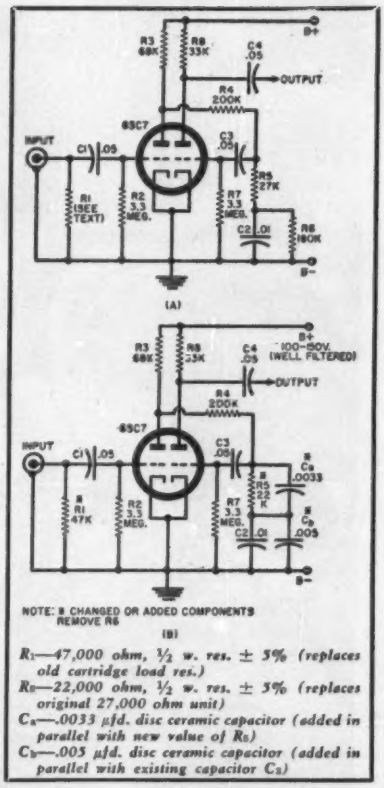
Although individual component values will vary from one circuit to another, the alterations indicated will apply, if a duplicate circuit *arrangement* is employed. For instance, the *Bogen* DB-10 includes the same general circuit structure in its preamp section. In the *Bogen* circuit, however, the equivalent equalizer components R_4, R_5, and C_2 are 100,000 ohms, 15,000 ohms, and .01 μfd. respectively. Note that C_2 is the only identical value as compared to the *G-E* preamp, but the circuit arrangement is the same. Therefore, irrespective of equalizer component differences, the changes listed for the *G-E* preamp will apply to the DB-10 circuit. More specifically, the changes would be: R_4, a 100,000 ohm resistor would become 200,000 ohms; C_a should be added across the new value of R_5; C_b should be connected in parallel with C_2; R_1, a 47,000 ohm resistor, should already be in place in this particular model.

Regretfully, however, these revisions will not apply where equalization is effected in a feedback loop, but all circuits of the type mentioned may be converted. In other words, any preamp having the same circuit configuration as the *G-E* unit, but not necessarily the same parts values, may be converted according to these instructions.

Performance

Test results showed the new equalization network's response curve to be an almost exact replica of the standard curve. Refer to Fig. 1 for this comparison. The contour of the network curve follows that of the RIAA standard quite closely. Any minute deviation from the standard curve can be attributed, for the most part, to normal variation in component tolerances and a slight interaction between the bass boost and treble cut sections of the network. Five per-cent tolerance resistors should be used if possible; close tolerance capacitors are also suggested. It should be noted, however, that the author obtained the results indicated on the graph using ± 10% units—but this may have been luck.

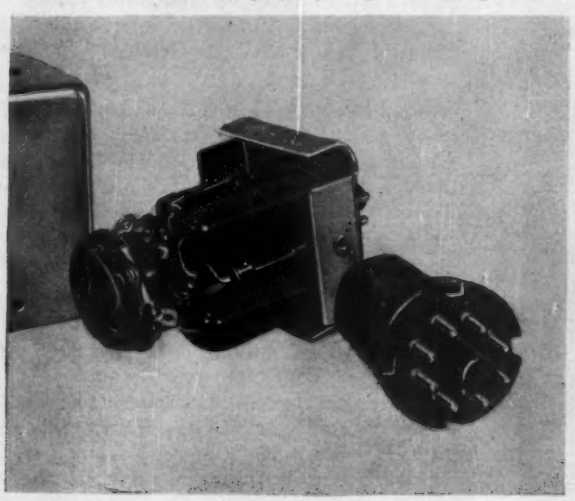
Listening tests were conducted and proved equally encouraging. Actually, the results of the listening tests alone were convincing enough to make the circuit modifications permanent. Low-noise, carbon-film, plate-load resistors, R_3 and R_4, were added by the author at the time the other changes were made. —30—



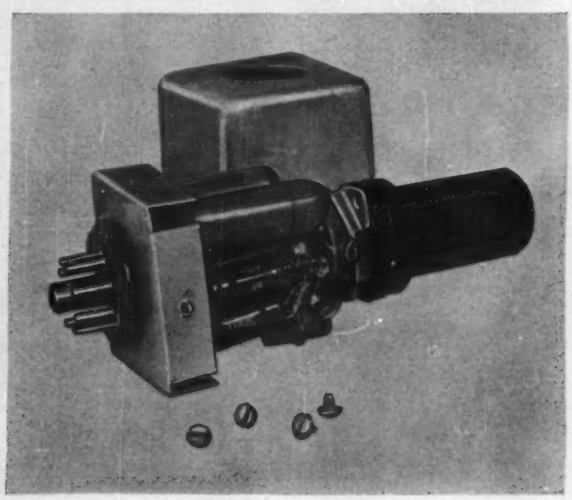
R_1—47,000 ohm, ½ w. res. ± 5% (replaces old cartridge load res.)
R_5—22,000 ohm, ½ w. res. ± 5% (replaces original 27,000 ohm unit)
C_a—.0033 μfd. disc ceramic capacitor (added in parallel with new value of R_5)
C_b—.005 μfd. disc ceramic capacitor (added in parallel with existing capacitor C_2)

Fig. 2. (A) Schematic diagram of the original G-E SPX-001 circuit. (B) Revised version of the circuit as discussed in the text.

Disassembled view of the plug-in preamp reworked by author.



Another view of the preamplifier with the 6SC7 tube in place.



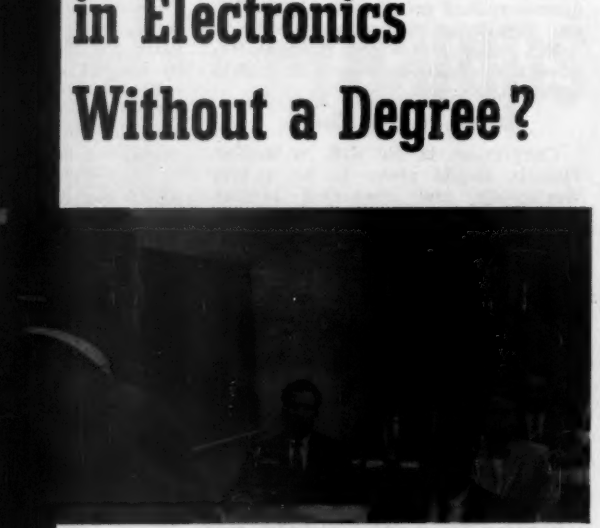
What is Project SAGE?

SAGE means Semi-Automatic Ground

at McGuire Air Force Base, but his education was not yet completed.

If you have two years' education and/or experience in electronics

How Far Can You Go in Electronics Without a Degree?



"Student" Fred Gunther in the IBM school

Fred Gunther has no degree. Yet, today, at IBM, Fred is a Technical Engineer working on America's biggest electronics project. His story is significant to every technician who feels that lack of formal training is blocking his road to the top.

Let's go back to 1950 and watch Fred Gunther, at 18, as he goes about the business of determining his life's work. Fred spent almost a year trying his hand at various jobs. None of these turned out to be the one that Fred wanted to devote his life to. So, still undecided about his career, Fred entered the Navy for a four-year hitch.

Fred learned something very valuable in the Service, as have many other men who eventually discover the electronics field. His aptitude tests revealed him as an excellent electronics prospect, and he received ten months' training in electronics fundamentals and radar. Upon his discharge in 1955, he was an Electronics Technician, First Class.

Something even more important to Fred's career occurred during his Service hitch. He began to hear such terms as "automation" . . . "data processing" . . . "electronic computer." "Then, one evening, while glancing through the paper," he recalls, "I spotted a story about *Project SAGE.*"

What is Project SAGE?

SAGE means Semi-Automatic Ground Environment. It is part of America's radar warning system—a chain of defense that will ultimately ring our country's entire perimeter. At the heart of this system are giant electronic computers which digest data filtered in from Texas towers, picket ships, reconnaissance planes, ground observers. The computers analyze this information for action by the Strategic Air Command and other defense units. These computers are the largest in the world. Each contains 58,500 vacuum tubes plus 170,000 diodes. They are built for the project by IBM.

Answering instructor's questions

Fred joins IBM

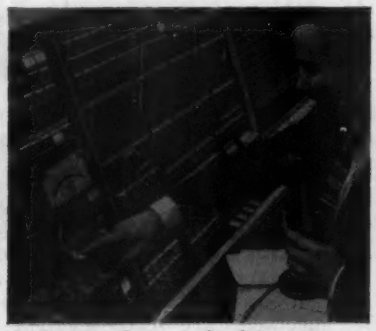
SAGE fascinated Fred, for it embodies the most advanced electronic concepts in giant computer work. And, when he learned that IBM would train him at full salary, plus a living allowance, to become a Computer Units Field Engineer, he seized the opportunity. Fred started his new electronics career in the IBM school, with twenty other technicians. He attended classes 8 hours a day. Courses consisted of some 20 subjects—computer circuitry and units, maintenance techniques—everything he would need to become a full-fledged Computer Units Field Engineer.

Assigned to McGuire AFB

His training completed, Fred was assigned in May, 1956, to McGuire Field, where the first of the giant SAGE computers is located. Here he assisted in the cable installation for this vastly complicated electronic giant. He helped to set up the computer, interconnect its many sections, check it out and make it ready for operation. Fred spent five months at McGuire Air Force Base, but his education was not yet completed.

Becoming a Computer *Systems* Engineer

"I like to think it was due to my interest and grade of work," Fred says, "but at any rate, last October I was invited to return to Kingston for further training—to become, in fact, a Computer Systems Engineer. Naturally, I was proud and pleased, for this training would give me a much greater range of understanding . . . make me more valuable to the company and myself . . . and give me a chance to assume actual engineering responsibility." Fred completed the



At the operating console of the computer

Computer Systems course. After several months of outstanding work in his new capacity, he received a *third* promotion—to Technical Engineer—in a field engineering liaison group.

What does the future hold?

What does the future hold for Fred Gunther, now that he has become a Technical Engineer? "It's hard to even set a goal in a field as rapidly moving as this," Fred says, "but with my IBM training back of me, the future sure looks good. I've advanced from Radar Technician to Computer Units Field Engineer to Computer Systems Engineer to Technical Engineer *in two years*—and received a valuable electronics education besides!"

How about YOU?

Since Fred Gunther joined IBM Military Products and the Project SAGE program, opportunities are more promising than ever. This long-range program is destined for increasing national importance, and IBM will invest thousands of dollars in the right men to insure its success.

If you have two years' education and/or experience in electronics gained through technical schooling or military service, you can become a member of this important, permanent, expanding project as a Computer Units Field Engineer.

You'll receive twenty weeks' training at Kingston, N.Y., with full pay, plus living allowance, before assignment to a permanent location of your choice. You'll receive salary, not wages, plus overtime pay.

This intensive training leads to positions of unusual responsibility. Thousands of IBM electronic engineers, graduates of this course, can vouch for its effectiveness.

Home to the family, Pemberton, N. J.

And, of course, you'll receive the famous IBM company-paid benefits that set standards for industry today.

• • •

WRITE TODAY to:

Mr. N. H. Heyer, Room 650L
Military Products Division
IBM Corp., Kingston, N.Y.

You'll receive a prompt reply. Personal interviews arranged in all areas of the United States if your résumé of experience and education indicates you have the qualifications.

IBM MILITARY PRODUCTS

- DATA PROCESSING
- ELECTRIC TYPEWRITERS
- MILITARY PRODUCTS
- SPECIAL ENGINEERING PRODUCTS
- SUPPLIES
- TIME EQUIPMENT

RCA offers you the

HI-FI
ENGINEERED FOR THE FUTURE
ENGINEERING • STYLING • PERFORMANCE
ARKAY STEREO HI-FI KITS AND PREWIRED

ARKAY FM-8 Professional Standard FM TUNER
Engineered for precise FM reception Arkay "Miracle Ear Sensitivity" provides 1.9 uV for 20 db quieting. Freq. Response 20-20,000 cps. Outstanding features include 3 tuned RF stages, dual limiters, Armstrong variable AFC Silent tuning system, tuning meter, cathode follower, high-level & Binaural FM (multiplex) outputs, 0-100 log scale for station pinpointing, self-contained AC power supply plus many other extras
KIT $39.95 WIRED $59.95
ARKAY AM-5 AM TUNER Most sensitive AM tuner. "Miracle Ear" 2 uV for 20 db S/n Wide & Narrow Band 3 gang tuning cond 10Kc whistle filter
KIT $23.45 WIRED $35.95
HFT-7 AM-FM Tuner. AFC. Sensitive
KIT $32.00 WIRED $49.95

ARKAY MODEL FL-30 HI-FI AMP PRE-AMP
An engineering masterpiece TRANSISTORIZED front end assures finest in Hi-Fi sound. Freq response ½ db. 10-40,000 cps @ 30 watts, 50 watt peak inputs for magnetic pickup, tuner, tape & 2 aux. Complete with step-by-step plans, handsome black cabinet & rose gold panel.
KIT $49.95
WIRED $74.95

ARKAY STEREO AT SENSIBLE PRICES!
At last the economical audiophile can enjoy "living sound".
MODEL SA-25 – Just attach your present amp to this dual channel preamp & 25 watt amp.
KIT $59.95
WIRED $89.95
MODEL SP-6 – Dual channel pre-amp with cathode follower.
KIT $34.95
WIRED $47.95
MODEL ST-11 – Binaural stereo tuner highly sensitive AM & FM reception.
KIT $47.95
WIRED $69.95

SEE N'HEAR THESE ARKAY UNITS!
Arkay FL-10—12 watt amp pre-amp—only $28.95
Arkay A-12—Amp pre-amp for budget-minded. Output 12 watts. Easily assembled $22.95
Arkay FL-5—5 watt amp—gives true hi-fi performance kit for beginner $15.25
Arkay 12" Hi-Efficiency Speaker System Kit 17x17½x15 5/16" Simple: Nail, glue and stain $12.95. Model B-12S with Co-ax spkr. and Bal. $25.00
Arkay TR-6—All-transistor portable superhet kit output better 275 mil watts 540–1620 kc. Superb tone; Const. extremely simple $37.50
Arkay TR-5 Personal Portable—5 transistor, printed circuit printed layout component kit. assembled 3 kc High impact styrene case. jack for pvt. listening $31.45

Prices 5% higher west of Mississippi
FREE! At your dealer or write for complete catalogues of Stereo & Monaural HI-FI, Radio & TV, Kits & Wired.

arkay LEADERS IN AUDIO TV & HI-FI EQUIPMENT
120 CEDAR STREET NEW YORK 6, N. Y.

At Your Dealer Insist on Hearing the Fabulous "LIVING SOUND" STEREO

COVER STORY

A "Color-full" Christmas

Heavy promotion plus increased net programming are boosting color sales. Goal is 1 million sets by 1960!

THERE is very little doubt about it—color TV is catching on and each week sees more and more choice programming time being devoted to the transmission of color. In addition to an impressive line-up of specially telecast "spectaculars," a number of made-to-order color spectacles are on the agenda—like the Tournament of Roses on New Years Day, etc.

According to recent estimates, there are some 130,000 color receivers in the hands of the public at the present time. Such viewers will, by the end of December, have had almost 300 hours of colorcasts for their delectation since the Fall TV season began. The World Series, the NCAA college football games, and other notable events were colorcast during the early Fall, along with daily programs which are regularly transmitted in tints.

It is only a matter of time until the number of color sets tops the "magic million" mark —some say that 1960 will be the year. If so, owners of color sets will find that over 250 of the nation's stations, serving some 96% of the country's TV homes have color facilities.

The bulk of color receivers at the present time is coming from RCA's production lines although modest numbers are being turned out by other firms. To support the parent company's product, NBC is programming color heavily. Admittedly the program is a money loser now but the network feels that when color catches on and set sales reach a quarter of a million, the investment will pay off. The economics of color are similar to the dilemma which faced early black-and-white telecasters. Advertisers wouldn't sign up for programs without an audience and the customers wouldn't buy TV sets unless they were assured of something worthwhile to view. Color is in the same fix.

Heavy promotional efforts are backing up the current sale of 1958 model color receivers. Trial offers involving varying periods of time are receiving special emphasis with the modest "rental" fee to be applied against the purchase price if the customer decides in favor of keeping the colorset.

During the period of the "big push," the network has programmed hours of special and feature events in color, to give the customer-to-be a chance to evaluate the advantages of owning a color receiver.

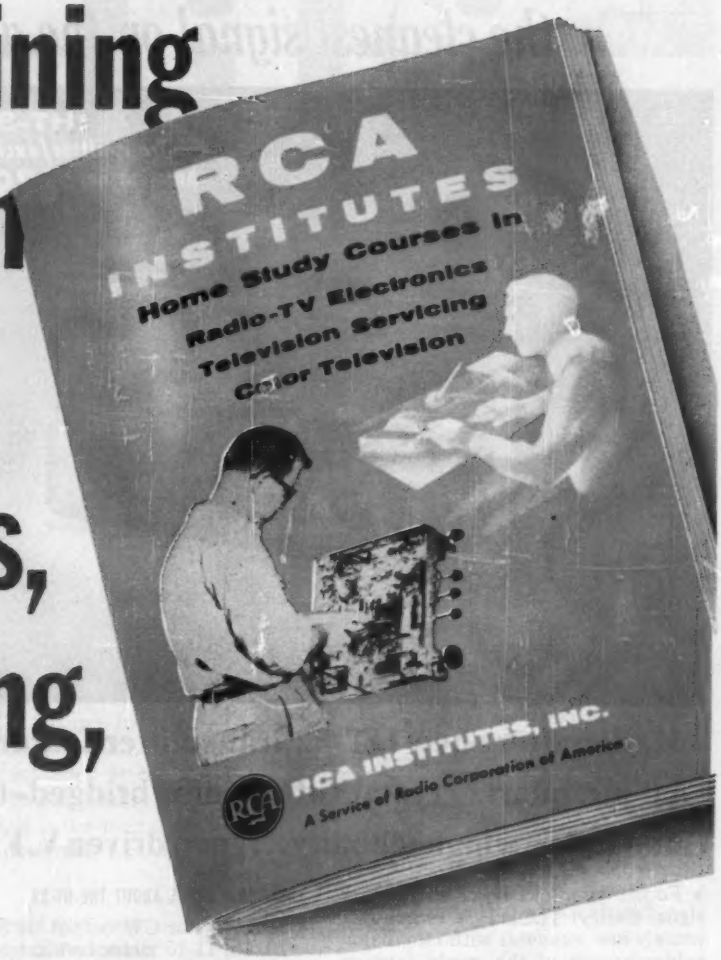
One of the traditional Christmas-season programs, "Amahl and the Night Visitors," has been tentatively scheduled by NBC for December 22nd presentation this Yule in full color as well as in black-and-white.

In the scene from Gian Carlo Menotti's miracle opera shown on this month's cover, the program is being picked up by an RCA Model TK-41 color camera and the audio portion is handled by a studio-type Model 77-D microphone. (Photo by NBC News Dept.) -30-

From this exclusive HIGH

RADIO SERVICE TV
Service

RCA offers you the finest training at home in Radio-TV electronics, TV servicing, Color TV



SEND FOR THIS FREE BOOK NOW!

Pay-as-you-learn. You need pay for only one study group at a time. Practical work with very first lesson. All text material and equipment is yours to keep. Courses for the beginner and advanced student.

RCA INSTITUTES, INC.
A SERVICE OF RADIO CORPORATION of AMERICA
350 WEST FOURTH STREET, NEW YORK 14, N.Y.
In Canada—RCA Victor Company, Ltd., 5001 Cote de Liesse Rd., Montreal 9, Que.

RCA Institutes, Inc., Home Study Dept. N-127
350 West Fourth Street, New York 14, N. Y.
Without obligation, send me FREE 52 page CATALOG on Home Study Courses in Radio, Television and Color TV. No Salesman will call.

Name.....
Please Print
Address.....
City..... Zone.... State.....
KOREAN VETS! Enter discharge date.....
To save time, paste coupon on postcard

A special Pre-Publication Offer to readers of RADIO & TV NEWS

From this exclusive HIGH FREQUENCY filter originates the cleanest signal on the air!

Hallicrafters new HT-32 transmitter features 5.0 mc. quartz crystal filter...new bridged-tee modulator...high stability...gear-driven V.F.O.

• Forget your old ideas about SSB signal clarity! The HT-32 establishes *entirely new standards* with two major achievements of the world famous Hallicrafters laboratories—yours exclusively in the HT-32:

1. **5-0 mc. quartz crystal filter.** Result of a 3-year research program, the crystal filter system now is commercially practical at *high frequencies*. System cuts unwanted sideband 50 db. or more!

2. **New bridged-tee modulator.** Temperature stabilized and compensated network provides carrier suppression *in excess of* 50-db. Patented diode application develops sideband energy from audio voltage. World's most stable modulator.

These and many other features make your decision *clear*—compare the HT-32 with any other transmitter available. Your supplier has all the details. Stop by and see him today.

Export Sales: International Operations
Raytheon Manufacturing Co.
Waltham, Massachusetts

ADDITIONAL FACTS ABOUT THE HT-32

- SSB, AM or CW output on 80, 40, 20, 15, 11-10 meter bands.
- High-stability, gear-driven V.F.O.
- 144 watts peak power input.
- Distortion products down 30 db or more.
- Complete band switching.
- P.T.O. direct reading in kilocycles.
- C.V.I. suppressed.

NEW FROM hallicrafters
CHICAGO 24, ILLINOIS
WHERE THE BEST IDEAS IN COMMUNICATIONS ARE BORN

Available with convenient terms from your Radio Parts Distributor.

Service Industry News

LEADING service dealers in all sections of the country are moving steadily toward full acceptance of their responsibilities in creating a healthier business climate for the independent electronic service industry. This national trend is reflected in a number of ways. One is the steady growth of informal associations, as well as the organization of many new associations of the conventional type in many states. Another is the acceptance of the part-time operators who operate legitimate service businesses as full-fledged members of service business associations.

The major problems recognized by leading service dealers can be broadly lumped into three categories. These are (1) the promotion of better public and customer relations, (2) the training of service personnel, and (3) legal means to protect dealers against dishonest and unscrupulous service customers.

Since the majority of the pressing problems that confront the service industry must be taken care of at local and state levels, a high percentage of service dealers feel they should employ their time and resources to the developing of local and state-wide service associations. In North Carolina, for example, a strong movement is under way to create a state-wide organization of local service associations in order to be able to deal effectively with some of the problems of the service industry in that state which will require action by the State Legislature.

One of the leaders in the movement to bring about the formation of a state-wide organization of service associations in North Carolina is David T. Drage of Bethania. Mr. Drage is president of the local ETA.

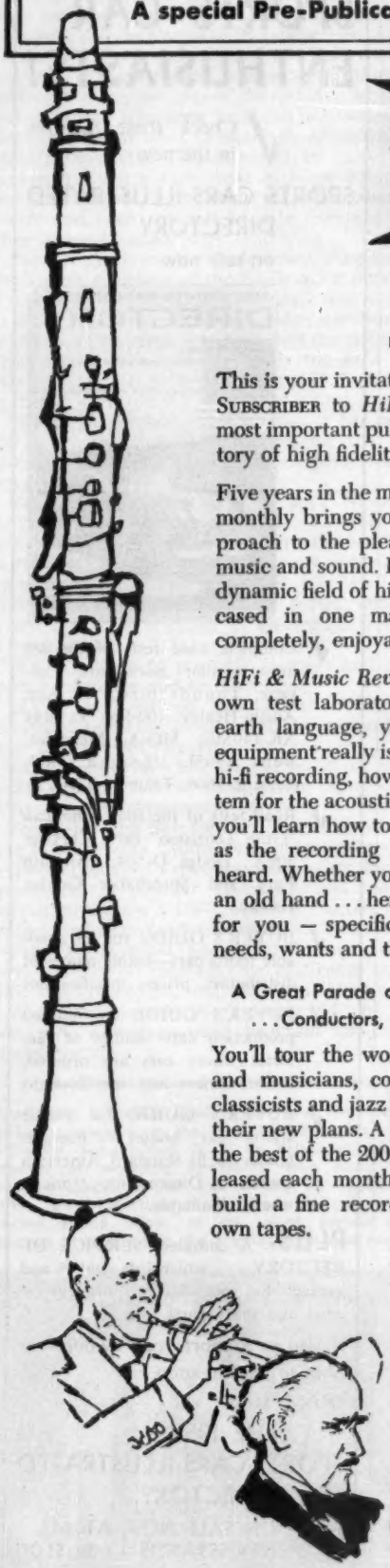
The Electronics Technicians Association, Inc., meets monthly in the Robert E. Lee Hotel in Winston-Salem. Its membership is composed of about fifteen service businesses in that area. Other officers working with Mr. Drage in the management of ETA include L. M. Richardson of *D & R Radio & TV Service*, Winston-Salem, vice-president; Harry L. Carithers of the *Rominger Furniture Company*, assistant vice-president; C. M. Pardew of *Salem Electronics*, secretary; and R. M. Tamer of *Salem Electronics*, treasurer. Information about plans for forming a North Carolina state organization may be obtained by writing to David T. Drage, Pres., ETA, Inc., P. O. Box 5193, Winston-Salem, N. C.

An association recently formed in Durham got off to a good start with

a fifteen-minute TV program aired through the cooperation of its local

SPORTS CAR

A special Pre-Publication Offer to readers of RADIO & TV NEWS



HiFi
& MUSIC REVIEW

Become a Charter Subscriber to America's newest, most exciting magazine for high fidelity enthusiasts

This is your invitation to become a CHARTER SUBSCRIBER to *HiFi & Music Review*, the most important publishing project in the history of high fidelity!

Five years in the making, this new Ziff-Davis monthly brings you a completely fresh approach to the pleasure-filled world of hi-fi music and sound. For the first time, the vast, dynamic field of high fidelity music is showcased in one magazine – authoritatively, completely, enjoyably.

HiFi & Music Review will take you into its own test laboratory. In simple, down-to-earth language, you will learn what hi-fi equipment really is, how to recognize a truly hi-fi recording, how to select and place a system for the acoustics of your home. In short, you'll learn how to reproduce sound exactly as the recording artist intended it to be heard. Whether you're a beginner in hi-fi or an old hand . . . here at last is the magazine for you – specifically designed for your needs, wants and tastes!

A Great Parade of Classical and Jazz . . .
. . . Conductors, Composers, Performers

You'll tour the world of music. Composers and musicians, conductors and arrangers, classicists and jazz buffs discuss their works, their new plans. A panel of experts analyzes the best of the 200 recordings and tapes released each month. You will learn how to build a fine record collection, make your own tapes.

From jazz groups to string quartets . . . the New York Philharmonic to the big band of Kenton . . . the mood music of Gleason to the etudes of Chopin . . . Brubeck . . . Erroll Garner . . . Mantovani . . . Scarlatti . . . Satchmo . . . Beethoven . . . Stravinsky . . . stereo tape or 33⅓ rpm—whatever in the incredible world of music and sound interests you most – you're sure to find it in *HiFi & Music Review*.

8 Months for only $2

Because we believe that you are the kind of person who will best appreciate a magazine of this scope and caliber—you are cordially invited to become a CHARTER SUBSCRIBER at the special rate of 8 months for only $2. Upon publication, *HiFi & Music Review* will cost 35¢ a copy, but this special pre-publication offer saves you more than 28% over single-copy costs . . . brings you 8 big issues at only 25¢ each.

HiFi & Music Review will be lavish . . . generously illustrated, printed on the finest glossy paper obtainable. Because of its costly production, it will be published in a limited "collector's item" edition.

If you subscribe right now, you will be certain to receive a first-edition copy of Volume I, Number 1, and a handsome CHARTER SUBSCRIPTION CERTIFICATE, suitable for framing. Again, supplies of first-edition copies will be *limited*, so please fill out and mail the application below *today*.

MONEY-BACK GUARANTEE
If, at any time, or for any reason, you are not satisfied with HiFi & Music Review, we will immediately send you a 100% refund on the unused part of your subscription.

First Issue: January, 1958.

Charter Subscription Application

HiFi & Music Review, 64 East Lake Street, Chicago 1, Ill.

Please enter my Charter Subscription to HI FI & MUSIC REVIEW to start with Vol. 1, No. 1, in January, 1958—at the special rate of 8 months for only $2. Also send my Charter Subscription Certificate.

☐ Payment Enclosed. ☐ Bill me.

Save us billing costs and we'll add an extra issue free—making 9 issues for only $2! R127

Name_____

Address_____

City_____ Zone____ State_____

hope that radical developments would make a cheaper set available. They now feel that, even if such developments clear the laboratories, it will take a number of years before such sets will be available in production quantities.

YOU CAN BUILD A

a fifteen-minute TV program aired through the cooperation of its local television broadcast station. Organized under the name of "The Radio & TV Dealers Association of Durham, N. C.," the officers have developed an aggressive program for building set-owner confidence in independent TV service shops. They hope it will appeal to service dealers in the smaller communities in the Durham trading area, so that membership in the association and participation in its programs will be shared by all of the top service shops in that section of North Carolina.

Charles S. McBroom, owner of *Mac's TV Service*, is president of the Durham association. Other officers include Garland Hoke of *Hoke Radio & TV*, vice-president; L. L. Leathers of *Leathers TV Service*, secretary; and Walter Cobb of *Cobb's TV and Sound Service*, treasurer. In addition to the companies represented by the officers of the association, shops that participated in the formation of the association include *Linthicum Radio & TV Service; Long's TV Service; Maurlee Electronics Co.; Montgomery & Aldridge TV Service; Miller-Hurst TV Service; Brunson's TV Service; United Radio Service;* and *Wallace's Radio & TV Service.*

Long before the formation of the new service association, several of the Durham service dealers cooperated in sponsoring an electronic technician apprentice training program under the program available through state educational institutions with the cooperation of the apprenticeship training section of the U. S. Department of Labor. Participating companies report that this program has been highly successful and has helped in up-grading a number of technicians in their organizations.

Information about the activities of the Durham association may be obtained from L. L. Leathers, secretary, 108 Southerland, Durham, N. C.

Fifteen service dealers in Fayetteville, N. C., recently formed an organization known as the Retail Appliance Credit Union of that city. In addition to an exchange of credit information, the new association is intended to promote a healthier business atmosphere for independent service dealers in that section.

In the transition that has been taking place at the retail level during the past five years, many service dealers added the sale of television receivers to their activities. While the bread-and-butter base of their businesses is still television and radio service, consumer interest in buying TV sets from concerns that are competent to service them has brought a steady growth in their TV receiver sales.

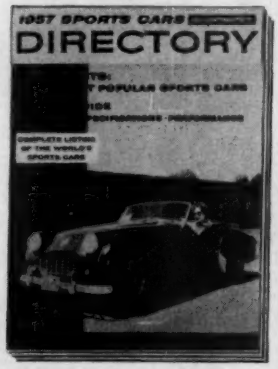
Service dealers in the Fayetteville area are planning to push the sale of color television receivers aggressively in the months ahead. Like dealers in many other parts of the country, they had held off pushing color TV in the

SPORTS CAR ENTHUSIASTS!

✓ Check these features in the new

SPORTS CARS ILLUSTRATED DIRECTORY

on sale now



- ✓ Complete road tests of the ten most popular sports cars—Corvette, Thunderbird, AC Ace, Austin-Healey 100-Six, Jaguar XK-140MC, MG-A, Mercedes-Benz 190SL, Morgan TR-3, Porsche 1600, Triumph TR-3.
- ✓ Road tests of the four American "Gran Tourismo" cars: Chrysler 300-C, Dodge D-500, Plymouth Fury and Studebaker Golden Hawk!
- ✓ BUYER'S GUIDE for all available sports cars—listing names of distributors, prices, specifications
- ✓ BUYER'S GUIDE for limited production cars—names of factories where cars are ordered, factory prices and specifications
- ✓ BUYER'S GUIDE for plastic sports car bodies — fiberglas bodies to fit standard American frames. Dimensions, prices, where obtainable.

PLUS: A complete SERVICE DIRECTORY . . . which lists dealers and garages that specialize in sports car repairs and spare parts.

If you're a sports car owner—or plan to be one soon . . .

DON'T MISS

THE 1958 SPORTS CARS ILLUSTRATED DIRECTORY

ON SALE NOW AT ALL NEWSSTANDS—only $1.00

hope that radical developments would make a cheaper set available. They now feel that, even if such developments clear the laboratories, it will take a number of years before such sets will be available in production quantities.

Edmund F. Barbour, Jr., of the *Television Service Center, Inc.*, of Fayetteville, expressed the thinking of service dealers in many sections of the country when he said, "The present color television sets can reproduce a telecast in black and white that is equal to or superior to the best monochrome sets. When tuned to color programs, the viewer is given a rare treat in home entertainment. We feel it is time we forgot about potential laboratory developments and push the sale of sets that are available now. They are very good."

Further typifying the "color consciousness" among service dealers, members of the Radio & TV Service Association of Santa Clara Valley, California, were deeply interested in the concerted promotion of color television held recently in the San Francisco Bay Area and the Santa Clara Valley. The promotion was sponsored by the *RCA Victor* distributor in the area with more than 100 dealers participating in it.

The announcement by *NBC* that it has scheduled about 250 hours of color programming for the fourth quarter of this year has stimulated dealer interest in color TV set promotion.

Vern La Plante, editor of "ETAT News," in a recent outline of the objectives of the Electronic Technicians Association of Toledo, Ohio, crystallized succinctly the motivating forces back of practically every electronic service association. Said La Plante:

"ETAT wants to promote a better understanding between everyone engaged in electronic servicing and the general public.

"ETAT wants to promote fairness and honesty to the service customer and to ourselves.

"ETAT will defend individuals or firms engaged in electronic servicing from unfair or unfounded attacks on their professional integrity.

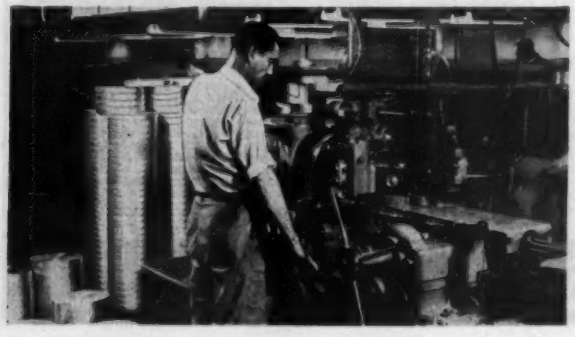
"ETAT endeavors to raise the technical level and ability and to promote healthy competition between individuals or firms engaged in electronic servicing."

The Television Service Association of Michigan is planning a large scale "Midwest Electronic Forum" to be held in Detroit during February 1958. This forum is an outgrowth of the popular TSA Colorama that was held in Detroit in January 1957, which attracted more than 500 dealers, industry leaders, and technicians.

The 1958 Midwest Electronic Forum will include technical lectures on monochrome and color television, radio, hi-fi, tape recorders, and industrial electronics. Business leaders from outside the industry will be brought in to help give a well-rounded program on service business administration. -30-

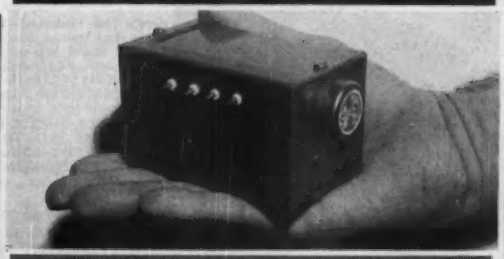
---

Giant lathe is being used to cut raw aluminum castings into finished turntables at the new $250,000 plant recently opened in Corona, Long Island, N. Y. by Rek-O-Kut, Inc., custom manufacturers of recording turntables, tone arms, and cartridges. The new 25,000 square foot facility is capable of more than double the production of the firm's old plant. A newly constructed sound booth at the plant permits turntable noise detection in addition to the regular wow and rumble procedures.



YOU CAN BUILD A TOROID TRANSISTOR POWER SUPPLY*

(D.C. to D.C. Converter)



*using this

TOROID TRANSFORMER

$16.00*

*Plus 50c for packing and mailing
Quantity prices on request

Delivers 225 to 450 volts D.C. simultaneously. Available in 12 or 24 volts. Maximum power 90 watts (transmitter intermittent service). 40 watts continuous.

AND

TRANSISTORS

2 Recommended Types—Both for

$11.00

MORE EFFICIENT! (80-90%)

LESS WEIGHT! (1/10 weight of equivalent Dynamotor Power Supply)

LESS SPACE! (90-watt output from 2" X 2" X 4" unit)

LOW HEAT GENERATION!

GREATER RELIABILITY!

- Designed especially for mobile and portable equipment.
- Each transformer tested in actual power supply unit and FULLY GUARANTEED!
- Complete construction details furnished.
- Special TOROID units and components to specifications on request.
- Manufactured by makers of world-famous SUNAir Aircraft Transceivers.

SUNAIR ELECTRONICS, INC.
Dept. O4
Broward International Airport
Fort Lauderdale, Florida

I am enclosing ☐ check ☐ money order in the amount of $16.50 for a TOROID TRANSFORMER, or in the amount of $27.50 for a Toroid Transformer and two matching power Transistors. ☐ 12 volts ☐ 24 volts

Name .....

Address .....

City ..... Zone ..... State .....

FREE!

LAFAYETTE RADIO

NEW 180 PAGE ELECTRONIC CATALOG FEATURING

Exclusive Lafayette Money-Saving Values

PROFESSIONAL TURNTABLE WITH HYSTERESIS-SYNCHRONOUS MOTOR

The Lafayette Model PK-225 is a *true* hysteresis-synchronous motor and is free from speed variations due to fluctuations in line voltage, load and temperature. It is the smoothest type known, completely free from "cogging" (the minute variations of speed which show up as wow and flutter)!

ONLY LAFAYETTE'S HYSTERESIS—SYNCHRONOUS MOTOR, in its price class, is made to extremely fine tolerances (on the order of .00001 inches)! Only Lafayette's motor has 16 cores; a high permeability rotor magnet, ball thrust bearings, oilite sleeve bearings plus felt oil reservoir, cooling fins as an integral part of the rotor and a hollow rotor core for maximum efficiency and minimum heat. Only Lafayette's motor can be oiled from above, without disassembly, through a unique oil feed system. Only Lafayette's motor has a self-aligning armature.

Here's THE turntable—the last word in professional high-fidelity performance! A fine precision instrument in every sense. Just look at some of these ***OUTSTANDING FEATURES:*** **WOW AND FLUTTER:** Less than 0.2% • **TURNTABLE:** Heavy, diecast aluminum. Lathe-turned for perfect balance and concentricity. 12" diameter—weighs approx. 4 lbs. and provides amazingly constant speed; the extra-heavy rim acts just like a flywheel to prevent speed variations • **TRUE-HYSTERESIS-SYNCHRONOUS MOTOR:** For smooth, low-noise, wow- and flutter-free operation • **RUMBLE AND NOISE:** 50db below average recorded level • **INTEGRATED SPEED CONTROL:** For all 3 speeds—78, 45 and 33⅓ rpm • **2 OVERSIZE, HEAVY DUTY IDLERS:** Precision-ground; provide positive constant-speed rim drive • **SINGLE BALL THRUST BEARING:** Turntable rides smoothly over ball bearing floating on thin film of oil • **FREE FLOATING, SHOCK-MOUNTED MOTOR** • **RUBBER CUSHION SHOCKMOUNTS** • **AUTOMATIC IDLER DISENGAGEMENT** • **CORK AND RUBBER MAT** • **STAINLESS STEEL PRECISION SPINDLE** • **POWER REQUIREMENTS:** For 105-130 volts, 60 cps AC; draws 16 V.A. • **ACCESSORIES SUPPLIED:** 45 RPM adapter, Strobe disc • **SIZE:** 2⅛" above and 4" below motor board; 14¼" deep x 12¼" wide • **SHIPPING WEIGHT:** 16 lbs.

Deluxe Woodbase for PK-225 and 12" Tone Arm (Specify Finish). Shpg. wt., 13 lbs. ..... Net **14.95**

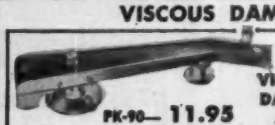
Deluxe Woodbase for PK-225 and 16" Tone Arm (Specify Finish). Shpg. wt., 15 lbs. ..... Net **15.95**

LAFAYETTE MODEL PK-225 ..... Net **64.50**

SPECIAL MONEY-SAVER COMBINATION

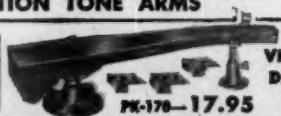
PK-225 Turntable, PK-90 12" Tone Arm, New GE VRII Series Triple-Play Cartridge Model 4G-052 with Genuine GE Diamond and Sapphire Styli. **SPECIAL!** ..... Net **81.50**

VISCOUS DAMPED TRANSCRIPTION TONE ARMS



PK-90— **11.95** — 12" VISCOUS DAMPED ARM

LICENSED UNDER CBS U. S. PATENT NO. 2676806



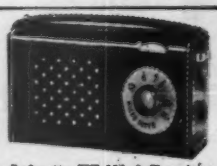
PK-170— **17.95** — 16" VISCOUS DAMPED ARM

LAFAYETTE MATCHED HIGH-FIDELITY PHONO SYSTEM

NOBODY BUT LAFAYETTE can bring you a phono system of this quality —and at this price. Indeed a Lafayette "best buy" system designed around the new **Lafayette LA-69 20 watt amplifier.** The performance of this phono system surpasses the most critical requirements of music lovers at a price below that of commercial phonographs. Twenty-four combinations of record equalization provide an almost endless variety of tone compensation to match varying recording characteristics. In addition to the LA-69 this system includes the famous **Garrard RC-121 4-speed Record Changer** featuring full automatic and manual positions and Simple-mix operation; the new improved **VRII Variable Reluctance GE Triple Play Turnover Cartridge Model 4G-052** with **genuine GE** diamond and sapphire styli, and the celebrated **Lafayette SK-58 12" Coaxial Hi-Fi Speaker.** All units are supplied with plugs, jacks and prepared coded interconnecting cables for quick easy installation. For 110-125 volt, 60 cycle AC. Shpg. wt., 50 lbs.

HF-179—Complete Phono System ..... Net **119.50**

6 TRANSISTOR SUPERHET RECEIVER KIT



- 100% SUBMINIATURIZED
- SENSITIVE, SELECTIVE, STABLE
- PUSH-PULL OUTPUT — PLENTY OF POWER
- AN INCOMPARABLE VALUE

The Lafayette KT-119 6 Transistor Superhet Transistor Kit provides superior commercial quality with maximum sensitivity, selectivity and stability. The circuit features 6 selected transistors and crystal diode, a specially matched set of 3 IF's, Oscillator coil, high Q loop, and audio transformer coupling. Has efficient 2¾" speaker and earphone jack for private listening. Complete with all parts, transistors, prepunched chassis and easy to follow step-by-step instructions. 6⅛" x 3½" x 1½". Shpg. wt., 3 lbs.

KT-119—Complete Kit—Less Case & Battery ..... Net **29.95**

BATTERY RCA VS300 ..... Net **1.23** **BURGESS P6** ..... Net **.77**

MS-339—Sturdy, attractive brown leather case with carrying strap for KT-119. Shpg. wt., 1 lb. ..... Net **2.95**

MS-366—Sensitive matching earphone Net **1.29**

3 TRANSISTOR SUPERHET POCKET RADIO KIT

- A TRUE POCKET SUPERHET RECEIVER
- NO EXTERNAL ANTENNA
- NO EXTERNAL GROUND

A remarkable sensitive, super-selective pocket superhet receiver with astonishing performance over the complete broadcast band. Uses 2 high-frequency and one audio transistor plus efficient diode detector and features 2 specially matched IF transformers for maximum power transfer. The components are housed in a professional looking beige plastic case. The receiver's appearance enhanced by attractive maroon and silver station dial. Sensitive built-in ferrite antenna eliminates need for external antenna. A designer's dream in a true pocket superhet receiver! Complete with all parts, transistors battery, case, dial and easy to follow step-by-step instructions. 4⅛" x 2⅝" x 1-1/16". Shpg. wt., 1 lb.

KT-116—Complete Kit, less earphone ..... Net **16.95**

MS-260—Super Power Dynamic Earphone ..... Net **3.95**

NEW POCKET AC-DC VOM MULTITESTER

2,000 ohm per volt sensitivity on both DC and AC

160 ua 3" METER 1% PRECISION RESISTORS

SILVER CONTACT SELECTOR SWITCH

FULL SCALE RANGES

D.C. Volts: 0-10; 0-50; 0-500; 0-1000 Volts—A.C. Volts: 0-10; 0-50; 0-500; 0-1000 volts—D.C. Current: 500 ua and 500 ma—Resistance: 0-10K; 0-1 Meg—Decibels: —20 to +22; +20 to 36 db (0 db—0.775 V)—Capacity: 250 mmfd. to .5 mfd—.005 mfd to 1 mfd—Output Ranges: 0-10; 0-50; 0-500; 0-1000 volts.

Best Buy in America! A very accurate and sensitive VOM. This Multitester is a complete instrument (not a kit) with high quality and sensitive 160 microamp meter; 2000 ohm per volt on both AC and DC. Single selector switch, 1% precision resistors, 3" meter. Features extreme versatility, accuracy and ruggedness. In attractive plastic front panel, with metal bottom for ruggedness and shielding. First capacity range requires 50 volt AC source. Second capacity range requires 10 volt AC source. Size 4¼" x 3½" x 1⅝". Complete with test leads and batteries. Shipping weight 4 lbs.

RW-27A ..... Complete **8.95**

HIGH SENSITIVITY 20,000 OHM PER VOLT DC 10,000 OHM PER VOLT AC MULTITESTER

LOOK AT THESE FULL SCALE RANGES!

D.C. Volts: 0-6; 0-30; 0-120; 0-600; 0-1200; 0-6000 Volts—A.C. Volts: 0-6; 0-30; 0-120; 0-600; 0-1200 Volts—Resistance: 0-10K; 0-100K; 0-1 Meg; 0-10 Megohms—D.C. Current: 0.60 Microamp; 0-6; 0-60; 0-600 Milliamps—Decibel: —20 to +17 db (0db—0.774V)—Capacity: .0001-.01; .005-.15 mfd—Inductance: 20-2000 millihenry—Output Ranges: 0-6; 0-30; 0-120; 0-600; 0-1200 Volts.

The new Lafayette high sensitivity Multitester is a complete instrument (not a kit). In addition to its unusual sensitivity of 20,000 OHMS PER VOLT ON D.C. AND 10,000 OHMS PER VOLT ON A.C., and the extraordinary number and scope of its ranges, it is packed with features that would make it cost at least twice as much if made in this country. Uses 1% precision resistors, silver contacts on selector switch, 35 ua 3" meter. Dependable, rugged and accurate. Even the test leads are heavy duty with high voltage insulation. Voltage source required for low capacity range is 120V for high range capacity and inductance scale is 6V A.C. Attractive plastic front with metal bottom. Size 6⅛" x 4¼" x 2¼". Complete with batteries and leads. Shipping weight 4½ lbs.

RW-30A ..... Singly, Each **19.95**

in lots of 3, Each **19.25**

Lafayette Radio — 165-08 Liberty Ave., JAMAICA 33, N. Y. — 100 SIXTH AVE., NEW YORK, N. Y. — BOSTON, MASS., 110 Federal St. — PLAINFIELD, N. J., 139 West 2nd St. — NEWARK, N. J., 24 Central Ave. — BRONX, N. Y., 542 E. Fordham Rd.

FREE! LAFAYETTE CATALOG

A Must For Every Hi-Fi Enthusiast

NEW 180 PAGE ELECTRONIC CATALOG FEATURING THE BEST BUYS IN THE BUSINESS

The newest and largest assortment of Electronic, Radio and TV parts, Hi-Fi and Public Address Components and systems, Test Equipment, tubes, Transistor Kits and miniaturized components for transistor circuitry, Ham Equipment, Builders Kits, Tools, Books, Microscopes, Binoculars, Telescopes, Cameras, and Drafting Equipment.—**ALL AT LOWEST PRICES**—Catering to the economy minded dealer, serviceman, engineer, technician, experimenter and hobbyist. **CRAMMED FULL OF MONEY SAVING BUYS. SEND FOR YOUR FREE COPY TODAY.**

Lafayette Introduces Hi-Fi Gems

... at prices everyone can afford

KT-300 IN KIT FORM 39.50

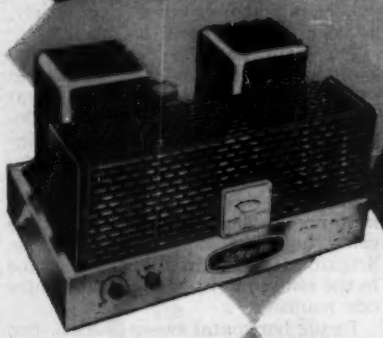
LAFAYETTE MASTER AUDIO CONTROL CENTER with BINAURAL CHANNEL AND DUAL VOLUME CONTROL.

Years Ahead of Every Other Control Unit ... Ahead In Sound ... Ahead In Styling Ahead In Design ... Ahead In Features ... Available In Kit and Wired Form

This is not only the finest hi-fi preamp characterized by unmatched features, but it has been functionally designed to keep pace with the conversion of your present hi-fi system to binaural (Stereophonic) sound. Incorporates an extra channel and dual volume control for binaural reproduction. Features include DC on all tube filaments, negative feedback in every stage, dual cathode follower output stages and latest printed circuit construction. Less than 0.09% IM distortion and less than 0.07 harmonic distortion at 1V. Hum and noise level better than 80 db below 3V. Uniformly flat frequency response over entire audible spectrum. 7 inputs for every type of phono, tuner or tape. Tasteful styling, brilliantly executed. Size 12¼ x 9⅛ x 3¾". Shpg. wt., 10½ lbs.

KT-300—Lafayette Master Audio Control Kit Complete with cage and detailed assembly instructions. ..... Net **39.50**

LT-30—Same as above completely wired and tested with cage and instruction manual. Net **59.50**



KT-400 IN KIT FORM 69.50

DELUXE 70 WATT BASIC AMPLIFIER

- **Conservatively Rated At 70 Watts**
- **Ultra-Stable**
- **Variable Damping**
- **Metered Balance And Bias Adjust Controls**
- **Available In Kit And Wired Form**

Here's ultra-stability in a 70 watt basic power amplifier employing highest quality components conservatively rated to insure performance and long life. Features matched pair KT 88's and wide range linear output transformer, variable damping control, meter for bias and balance and **gold finished** chassis. Frequency response 10-100,000 cps ± 1db. Hum and noise 90db below full output. IM distortion less than 1⅓% at 70 watts, less than 0.3% below 30 watts. Harmonic distortion less than 2% at 70 watts from 20 to 20,000 cps ± 1db. Output impedance 4,8 and 16 ohms. Handsome decorative cage perforated for proper ventilation. Size 14⅓ x 10 x 7⅜" including cage and knobs. Shpg. wt., 40 lbs.

KT-400—Lafayette 70 watt Deluxe Basic Amplifier Kit complete with cage and detailed assembly instructions. ..... Net **69.50**

LA-70—Same as above completely wired and tested with cage and instruction manual. Net **94.50**

LT-40 FM-AM "MUSIC MATE" TUNER 64.50 LESS CAGE

NEW! "MUSIC MATES" TUNER AND AMPLIFIER COMPLETELY WIRED AND TESTED

Lafayette CUSTOM HI-FI "MUSIC MATES" STYLE MATCHED TUNER AND AMPLIFIER

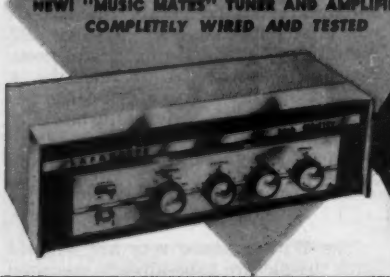
MODEL LT-40 "MUSIC MATE" DELUXE FM-AM TUNER

- **ARMSTRONG CIRCUIT**
- **AFC DEFEAT**
- **FOSTER-SEELEY DISCRIMINATOR**
- **TEMPERATURE COMPENSATED OSCILLATOR**
- **MEETS FCC RADIATION REQUIREMENTS**

A sensitive, selective, stable FM-AM tuner. Temperature compensated oscillator and AFC assure drift-free performance and "locking-in" of stations once they are tuned. The Armstrong circuit with limiter and Foster-Seeley discriminator uses 6 tubes, a rectifier and 2 long-life matched germanium diodes. Superior frequency response, hum and distortion specifications assure excellent reception. Has built-in antennas for both AM and FM as well as provision for outdoor antenna. Finished in attractive dark maroon and gold. Size 13½" W x 5⅞" D x 4-3/16" H. Shpg. wt., 10 lbs. Available with cage for shelf use or without cage for custom mounting.

Lafayette LT-41—FM-AM Tuner (Less Cage) ..... Net **64.50**

Lafayette LT-40—FM-AM Tuner (With Cage) ..... Net **67.50**



LA-40 15 WATT "MUSIC MATE" AMPLIFIER 43.50 LESS CAGE

MODEL LA-40 15 WATT "MUSIC MATE" AMPLIFIER

- **20-20,000 CPS ± .5DB**
- **TAPE HEAD AND RECORD EQUALIZATION**
- **LESS THAN 1% DISTORTION**
- **PUSH-PULL EL84 OUTPUT TUBES**
- **RUMBLE FILTER**
- **5 INPUT CHANNELS**
- **LOUDNESS CONTROL**

Brilliantly engineered, beautifully styled and moderately priced, this deluxe amplifier matches the tuner in both decor and performance. Utilizes new premium quality EL84 tubes in push-pull. In addition to separate bass, treble and volume controls, has 3 position loudness switch to retain correct tonal balance. 5 inputs, fully equalized, for Crystal or Ceramic Phono, Magnetic Phono, Tape, Tuner and Aux. A hum adjustment control minimizes subsidiary hum. Rumble filter switch to eliminate motor vibration. Speaker and tape output. Output impedances 4, 8 and 16 ohms. Has all of the prerequisite features for a fine hi-fi system. Size 12⅛" W x 8¾" D x 4¼" H. Shpg. wt., 12 lbs.

Lafayette LA-41—Amplifier (Less Cage) ..... Net **43.50**

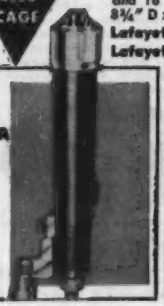
Lafayette LA-40—Amplifier (With Cage) ..... Net **46.50**

NEW "DYNA-SLIM" MICROPHONE

- **HIGH IMPEDANCE — 50,000 OHMS**
- **ON-OFF SWITCH**
- **"QUICK-SLIP" ADAPTER**

New dynamic, high output microphone with all the features of "mikes" costing 3 times Lafayette's price! Output level —55db. Smooth response from 60 to 10,000 cycles. Omnidirectional head. External on-off switch. Slips on or off stand adapter in a wink. Standard ⅝" — 27 adapter permits tilting mike for multi-angle use. Satin black and chrome finish. Complete with detachable cable and connector. 8" long, 1¼" max. dia. tapered panel. Shpg. wt., 2 lbs.

PA-43 ..... Net **6.95**



Lafayette Radio — DEPT RL — P. O. BOX 511 JAMAICA 31, N. Y.

NAME _____

ADDRESS _____

CITY _____ ZONE ____

STATE _____

SEND FREE CATALOG 305

CUT OUT AND MAIL TODAY!

ONE PRICE FOR EVERY TYPE OF TUBE

Quick, Easy Access to Your MINIATURE CHASSIS With XCELITE'S Handy Pocket NUTDRIVERS!

XCELITE POCKET NUTDRIVERS Available in your four most-needed sizes: 1/8", 1/4", 5/16" and 3/8" Hex.

Today's Increasing Miniaturization

prompted XCELITE to bring you these **Super-Handy** Pocket Nutdrivers with the convenient pocket clip.

You'll want to keep **all four** of these "just-right-hex-size" XCELITE Pocket Nutdrivers clipped in your shirt or coat pocket. They're ideal to reach those "hard-to-get-at" places in the new miniature and sub-miniature sets.

Fact is, XCELITE Pocket Nutdrivers are just like all the other **quality** hand tools in the line—XCELITE screwdrivers, regular nutdrivers, pliers, reamers, adjustable wrenches, kits. All XCELITE tools are precision-made especially for professional Radio, TV, Hi-Fi and Electronics Servicemen. Remember, XCELITE always brings you the **finest** tools **first!**

Call or See Your Dealer Today!

Order all four of these time-saving, work-saving XCELITE Pocket Nutdrivers. And, while you're at it, check your needs and order all the XCELITE Tools that will help you do your job better, quicker, more profitably!

XCELITE, INCORPORATED
Dept. E, Orchard Park, N. Y.
In Canada—Charles W. Pointon, Ltd.
6 Alcina Ave., Toronto, Ont.

For Originality LOOK TO XCELITE

NOW . . . Check Vibrators in ANY Tube Checker

Another Sencore Time-Saver

SENCORE "VIBRA-DAPTOR"

MODEL VB-2

2 ADAPTORS IN 1

Checks Both Three and Four Prong Vibrators

- Merely plug into any tube checker. Set for 6AX4 (or 6SN7) for 6 Volt Vibrators and 12AX4 (or 12SN7) for 12 Volt Vibrators.
- Two lamps viewed through top of adaptor indicate whether or not Vibrator needs replacing. • Rugged — Made of steel. • Replaceable but unbreakable #51 indicating Lamps. • Operates easily with Sencore LC2 Leakage Checker. • Complete instructions screened on front.

ONLY $2.75 DEALER NET

At leading distributors everywhere

POPULAR SENCORE PRODUCTS
- Transistor Tester
- Leakage Checker
- Filament Tester
- Handy "38"
- Vibra-Daptor

MANUFACTURED BY
SERVICE INSTRUMENTS CORP.
171 OFFICIAL RD. ADDISON, ILL.

Perma-Power MODEL A-400

TRANSISTOR POWER SUPPLY

Especially designed to operate, service and test transistor portable radios and low power transistor circuits. Features: • Continuously adjustable output using variable autoformer control • Two output voltage ranges (0-15 volts and 0-30 volts) for accurate setting of all transistor battery voltages • Two output current ranges (0-15 MA and 0-60 MA) monitor current for single transistor or entire set • Extremely low ripple (less than 500 uV — .002% at full load) for testing lowest level transistor circuits • Very low internal impedance (less than 20 ohms DC to R. F; including 7 ohm removable meter fuse) providing excellent regulation • 2% Precision D'Arsonval meters provide laboratory accuracy • Milliameter protected by front panel fuse; additional internal line fuse • Output isolated from line and case • Attractive Slope — Front, Maroon Hammerloid Cabinet — Rubber feet.

$64.50 NET
From Electronic Parts Distributors only

Perma-Power COMPANY
3100 N. ELSTON AVE. • CHICAGO 18, ILLINOIS
There's Always Something NEW Being Developed by Perma-Power

Westinghouse Color Sets

(*Continued from page 59*)

turning this a.g.c. bias to the B+ through an 18-megohm resistor, some a.g.c. delay action is obtained which helps on very weak signals.

The color-killer tube receives a control-grid bias from the 5AM8 diode. When a color-sync burst is received, this control bias will be negative, cutting the color-killer triode off and thereby keeping bias off the second chroma stage. When no sync burst is received, the d.c. voltage from the 5AM8 diode will be near zero and the color-killer triode will generate maximum bias for the second chroma amplifier.

By using multiple-purpose tubes, this rather neat and elaborate circuitry is obtained without adding to the overall number of tubes. It should be mentioned that, if the horizontal-oscillator circuit is out of synchronism or if the flyback circuit does not work properly, no color reception will be possible.

The color decoding section of the *Westinghouse* sets is very similar to previously described circuits. A dual triode is used for medium-level demodulation of the *R-Y* and *G-Y* signals, and a third triode section is employed as mixing amplifier for the *B-Y* signal. All three color-difference signals are applied to the picture-tube grids and are combined with the brightness signal in the picture tube in the now conventional common-cathode manner.

In the horizontal sweep section, two 25DN6 horizontal-output tubes are used in parallel with isolating plate chokes to avoid parasitic oscillations. Two 19AU4 damper tubes are similarly employed. Still another feature of conservative design is a small pulse transformer connected across the lowest two taps on the flyback transformer. This transformer has three secondaries, one of which is grounded at the center. These windings supply pulses for the color killer, keyed a.g.c., burst amplifier, etc. To obtain the 25,000-volt ultor potential, a single-stage 3B2 rectifier and 6BK4 regulator are used. The focus voltage is provided by a 1X2B miniature h.v. rectifier. The remaining circuitry is not substantially different from that used in most of the other color sets now before the consuming public.

Installation Data

The *Westinghouse* sets are shipped with the picture tube already mounted on the single chassis. Most installations will require some adjustments other than those of the viewer-operated controls, and a competent service technician is therefore required. Service literature supplied with these receivers stresses the need for good antenna systems, the absence of noise and ghosts, as well as sufficient r.f. bandwidth in the entire system. These and other prerequisites for color re-

ONE PRICE FOR EVERY TYPE OF TUBE

PROMPT SHIPMENT ON ALL ORDERS
DON'T PAY MORE FOR SET TESTED LONG LIFE DEPENDABLE RADIO & TV TUBES
BUY VIDEO INDIVIDUALLY BOXED
ALL GUARANTEED FOR ONE YEAR OR YOUR MONEY BACK

Some Standard Brand—Others With Famous VIDEO Brand

0A2, 0A3, 0A4, 0B2, 0C3, 0Z4, 1A7GT, 1B3GT, 1C7G, 1F4, 1H4, 1H5GT, 1J6GT, 1L4, 1L6, 1LA6, 1LC5, 1LH4, 1LN5, 1N5GT, 1S4, 1S5, 1T4, 1U4, 1U5, 1V2, 1X2, 2A7, 2D21, 2X2, 3A4, 3A5, 3AL5, 3AU6, 3BC5, 3CB6, 3Q4, 3Q5GT, 3S4, 3V4, 4B27, 4B97, 5AM8, 5AN8, 5AQ5, 5AT8, 5AW4, 5AZ4, 5J6, 5T4, 5T8, 5U4G, 5U8, 5V4G, 5V6GT, 5Y3, 5Y4G, 6AB4, 6AC7, 6AG5, 6AF4, 6AH4GT, 6AK5, 6AL5, 6AM8, 6AN4, 6H8, 6AQ5, 6AQ7GT, 6AS5, 6AS7G, 6AT6, 6AU4GT, 6AU5GT, 6AU6, 6BU5GT, 6AV6, 6AX4GT, 6AK5GT, 6BA6, 6BC5, 6BC7, 6BE6, 6BF5, 6BG6G, 6BH6, 6BJ6, 6BK5, 6BK7, 6BL7GT, 6BN6, 6BQ6GT, 6BQ7, 6BY5G, 6BZ7, 6C4, 6CB6, 6CD6G, 6CF6, 6CS6, 6CU6GT, 6E5, 6H6GT, 6J4, 6J5GT, 6J6, 6K6GT, 6L6, 6N7GT, 6S4, 6S7G, 6SA7, 6SB7Y, 6SC7, 6SF5, 6SF7, 6SG7, 6SH7, 6SJ7GT, 6SK7GT, 6SL7GT, 6SN7GT, 6SQ7, 6SS7, 6SV7, 6T8, 6U4GT, 6U7G, 6U8, 6V3, 6V6GT, 6W4GT, 6W6GT, 6X4, 6X5GT, 6X8, 6Y6G, 7A5, 7A7, 7B5, 7B7, 7C5, 7C6, 7C7, 7F7, 7F8, 7N7, 7Q7, 7Y4, 7Z4, 12A6, 12AH7GT, 12AT6, 12AT7, 12AU6, 12AU7, 12AV6, 12AV7, 12AX4GT, 12AX7, 12AZ7, 12B4, 12BA6, 12BE6, 12BH7, 12BY7, 12CU6, 12SA7, 12SG7, 12SH7, 12SJ7GT, 12SK7, 12SN7GT, 12SQ7, 12V6GT, 12X4, 14A7, 14B6, 14Q7, 19BG6G, 19T8, 24A, 25AV5GT, 25BQ6GT, 25CD6G, 25CU6, 25L6GT, 25W4GT, 25Z6GT, 35L6GT, 35W4, 35Y4, 35Z3, 35X5GT, 50A5, 50B5, 50C5, 50L6GT, 80, 117N7GT, 117P7GT, 117Z3

FREE RCA "CHEATER" CORD GIVEN WITH ANY TUBE ORDER OF $7.00 OR MORE!!

40¢ FOR ANY TUBE

$37.00 PER HUNDRED

We have OVER 1000 USED TV SETS

At All Times In Our Huge Warehouse

Buy one or more of these WORKING TVs to sell or use as your own second set! All Sets in GOOD WORKING condition!

Your Choice—Console or Table Model

10"	$23.00	19"	$58.00
12"	$28.00	20"	$64.00
14"	$33.00	21"	$72.00
16"	$40.00	24"	$99.00
17"	$46.00		

When ordering TV's, state whether table model or console is desired. Also preference on make of set. All TV's sent railway express F.O.B. Newark. On any quantity WIRE or CALL today!

SEND for our **FREE** complete TUBE & PARTS LIST and order blank.

FREE BONUS ANTENNA GIVEN WITH ANY TV SET ORDER!!

Brand New Factory Seconds! Electrically Perfect Factory Seconds! Used Tubes! New and Used Jan Surplus Tubes!

FREE POSTAGE in U.S.A. and Territories on orders over $5.00. 25¢ handling charge on orders under $5.00. 25% deposit required on C.O.D.'s. Please send approximate postage or freight on Canadian and foreign orders. Subject to prior sale.

VIDEO ELECTRIC COMPANY

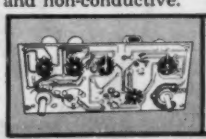
79 CLINTON PL. NEWARK, N. J. Phone HUmboldt 4-9848

Build the Best— build ALLIED knight®-kits

MORE ACTIVE! EFFECTIVE!

THE BEST FOR TV-RADIO WORK... EVERYTHING ELECTRICAL—Kester "Resin-Five" Core Solder is better and faster than any solder ever developed. It has an activated flux-core that does a perfect job on all metals including zinc and nickel-plate. The flux residue is absolutely non-corrosive and non-conductive.

Available in all practical Tin-Lead Alloys; 40/60, 50/50 and 60/40 in diameters of 3/32", 1/16", 3/64", 1/32" and others.



Printed Circuit Soldering
On Copper-etched boards use 60% Tin - 40% Lead Alloy . . . for those that are Silver-surfaced use 3% Silver-61½% Tin-35½% Lead

KESTER SOLDER COMPANY

4235 Wrightwood Avenue, Chicago 39, Illinois • Newark 5, New Jersey, Brantford, Canada

Amazing New Handbook Takes The "Headache" Out of TV Trouble Shooting

SAVES TIME... ELIMINATES GUESSWORK!

Now, a simple, practical way to accurately spot the cause of trouble in any TV set, FAST! Quick, easy-to-understand tests tell you in which of 5 TV set sections to find the cause of trouble. Fool-proof Check Charts help you locate the exact trouble spot at once, from as many as 700 possibilities. Book fits easily into your tool kit for handy on-the-job use. Over 300 spiral bound fast reference pages with 50 time-saving Check Charts; dozens of easy to understand diagrams and tests; explanations of circuits and designs. The hours and aggravation this amazing handbook can save you on a single servicing job more than pay its low price!

USE IT ON 7 DAYS FREE TRIAL!

Send no money, just the coupon. We'll rush your copy on FREE TRIAL. After 7 days, send only $3.95 plus postage or return the book and owe nothing. Act NOW!

MAIL COUPON NOW!

Educational Book Publishing Div.
COYNE ELECTRICAL SCHOOL, Dept. C7-RT
500 S. Paulina St., Chicago 12, Ill.

Rush TV handbook for 7 days FREE TRIAL per offer.

Name ..... Age .....

Address .....

City ..... Zone .... State .....

☐ Check here if $3.95 enclosed. We pay postage. 7-day money-back guarantee.

TERADO

Trav-Electric MOBILE POWER CONVERTERS

Give You **110 A.C. HOUSE CURRENT ANYWHERE** You Drive or Cruise

For 6 and 12 Volt Car Batteries—Capacities: 10 to 125 Watts

LIST **$11.95** UP

PORTABLE TV

NO INSTALLATION

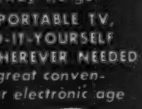
Just plug into cigar lighter on dash of car, truck, or boat—and away we go.

- OPERATE PORTABLE TV,
- SMALL DO-IT-YOURSELF
- TOOLS WHEREVER NEEDED

One of the great conveniences of our electronic age

DICTATION

101 USES


ALL ELECTRIC SHAVERS

DO-IT-YOURSELF HOBBY TOOLS

SEE YOUR ELECTRONIC PARTS DEALER OR JOBBER

TERADO COMPANY

DESIGNERS & MAKERS OF ELECTRONIC EQUIPMENT SINCE 1927

1058 RAYMOND AVE., ST. PAUL 14, MINNESOTA

ceivers have previously been discussed here and may naturally be extended to apply for the line of *Westinghouse* receivers.

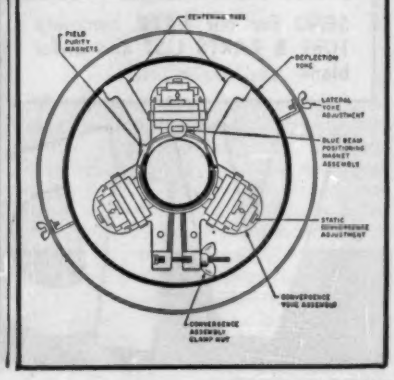
Controls available to the viewer include such monochrome controls as the vertical and horizontal hold controls. The access to these, especially the horizontal control, gives the set owner an opportunity to inconvenience himself with quite a bit of misadjustment. For example, if he obtains a marginal setting of the horizontal control, he can get an intermittent color picture or no picture at all. As for color controls, the only two available to him are the chroma gain and hue settings, but even these are subject to considerable misadjustment.

The various screen and background controls on the left-side panel shown in Fig. 5 are adjusted for a neutral gray screen in the absence of a color signal. Convergence adjustments are quite conventional, but should be made only after reading the detailed manufacturer's instructions and with the aid of a dot or cross-hatch generator.

The location of the various components on the neck of the color-picture tube is shown in the socket-end view of Fig. 7. The blue-beam positioning magnet and the convergence coils themselves are conventional, but the two large centering tabs are peculiar to the *Westinghouse* receiver. By adjusting the position of these tabs, both vertical and horizontal centering is provided. This is a considerable change from most previously described color sets which used centering transformers, potentiometers, and filters to achieve the same end. Adjustment of the centering tabs is slightly more critical than that of the electrical equivalents.

The first color TV set using a 22-inch rectangular glass-envelope picture tube also looks physically much like a monochrome set. The picture tube mounted on the single chassis, as well as the use of printed circuitry and series-filament tubes, definitely puts the new *Westinghouse* color receivers in the category of mass-produced, well-designed TV sets which have shed the cocoon of laboratory instruments and are bidding for full acceptance as consumer products. —30—

Fig. 7. Socket-end view of picture tube.



Now you can have Custom-Styled Hi-Fi in **ALLIED**

Build the Best– build ALLIED knight®-kits

the finest electronic equipment in money-saving kit form

LOWEST COST
ALLIED'S giant buying power passes biggest savings on to you—you do the easy assembly and your finished instrument equals the performance and appearance of equipment selling for several times the low KNIGHT-KIT cost. Your savings are BIG.

EASIEST TO BUILD
KNIGHT-KIT "Step-and-Check" instruction manuals with wall-sized picture diagrams are marvels of clarity—it's like having a good instructor at your side. No experience required—you can easily build any KNIGHT-KIT and get professional results.

LATEST DESIGN
Each ALLIED KNIGHT-KIT incorporates the very latest circuitry for top-quality performance. Tried and proved professional design and the use of premium quality parts throughout help insure your building success to bring you quality results.

COMPLETE KIT SELECTION:
- HI-FI
- HOBBY
- INSTRUMENT
- AMATEUR

MONEYBACK GUARANTEE. When properly assembled, KNIGHT-KITS fully meet published specifications or we refund your money in full.

EASY TERMS. If your KNIGHT-KIT order comes to $45.00 or more, you can make your purchase on our attractive Easy Payment Plan.

High Fidelity Everyone Can Afford

- World's Finest Hi-Fi Kits
- Custom-Styled
- Easiest to Build Hi-Fi
- Money-Saving

knight-kit High Fidelity FM-AM Tuner Kit

Model Y-787
$49.95
Only $4.99 down

- Latest Time-Saving Printed Circuit Design
- Flywheel Tuning
- Automatic Frequency Control
- 2.5 μv FM Sensitivity
- True High Fidelity Response
- Beautiful Custom-Styled "Space Saver" Case

The best-looking, best-performing FM-AM tuner kit your money can buy! Carefully designed for quick, easy construction—a tuner you'll enjoy assembling and be proud to own, both for its amazing musical performance and outstanding beauty. Covers the full AM broadcast band and 88 to 108 mc FM. On FM, *sensitivity is a remarkable 2.5 microvolts for 20 db of quieting;* hum and noise, –60 db; IF bandwidth, 200 kc at 50% down on curve; response, ± 0.5 db, 20-20,000 cps. On AM, *sensitivity is 3 microvolts for 10 db signal-to-noise ratio;* IF bandwidth, 8 kc at 50% down on curve; response, 20-8000 cps. Outstanding features include: Inertia Flywheel Tuning for effortless, accurate tuning; Automatic Frequency Control (plus AFC disabling) to "lock-in" FM stations; printed circuit board (with most of the kit wiring already done for you) assures time-saving, error-free assembly; pre-aligned RF and IF coils; tuned RF stage on FM; drift-compensated oscillator; neon glow tuning pointer; cathode follower output; two output jacks—one for recorder, one for amplifier; rotatable built-in ferrite antenna for AM. Includes beautiful French-gray case with chrome-finished tapered feet, 4 x 13 x 8". Ideal for use with 18, 20 or 30 watt KNIGHT-KIT amplifiers. Ready for easy assembly. Shpg. wt., 12 lbs.

Model Y-787. FM-AM Tuner Kit. Net only.....**$49.95**

knight-kit 18-Watt Complete Hi-Fi Amplifier Kit

Model Y-786
$39.95
Only $3.99 down

- The Last Word in Custom Hi-Fi Styling
- Full 18 Watts with Superb Hi-Fi Specifications
- 8 Inputs for Every Desired Signal Source
- Printed Circuit Switch and Printed Circuit Boards
- Full Equalization for All Record Types

Here is a custom-styled, easy-to-build complete Hi-Fi amplifier at a price that defies comparison. Delivers full 18 watts output with wide-range, flat frequency response for true hi-fi reproduction. Features 8 inputs for every possible signal source, including NARTB equalized tape head input. At full 18 watts output, distortion is only 0.5%; uses new RCA 6973 hi-fi output tubes. Frequency response is ± 1 db, 20-30,000 cps; tape head and magnetic cartridge sensitivity, 5 microvolts for 18 watts output; hum and noise level better than 60 db below 18 watts. Output taps for 4, 8 or 16 ohm speakers. Controls: Input and Record Equalization; Bass Boost and Attenuate; Treble Boost and Attenuate; Volume. Simplest assembly is made possible through the use of an exclusive printed circuit switch and two printed circuit boards—most of the kit wiring is already done for you. With custom-styled French-gray "space-saver" case on tapered feet finished in chrome, 4 x 13 x 8". Complete with case, tubes, all parts, and step-by-step instructions, for easy, error-free assembly. Shpg. wt., 15 lbs.

Model Y-786. 18-Watt Hi-Fi Amplifier Kit. Net only.....**$39.95**

EASY TERMS TO FIT YOUR BUDGET. ALLIED KNIGHT-KITS may be purchased under our Easy Payment Plan. Your order need total only $45.00 or more—only 10% down, small monthly payments thereafter. No red tape—fast handling assured.

Our 37th Year

® Registered Trade-Mark of Allied Radio Corporation

ORDER FROM ALLIED RADIO 100 N. WESTERN AVE. • CHICAGO 80, ILL.

knight-kits

THE VERY FINEST MUSICAL QUALITY—SO EASY TO BUILD
MONEY-SAVING HI-FI EVERYONE CAN AFFORD

Now you can have Custom-Styled Hi-Fi in ALLIED

knight-kit 30-Watt Complete Hi-Fi Amplifier Kit

Model Y-762

$76.95

Only $7.69 down

- Full Equalization, ±½ db of Recommended Accuracy
- Printed Circuit Switches • Printed Circuit Boards
- 8 Inputs For Every Possible Signal Source
- Full 30 Watts Output • Custom-Styled Beauty

Comparable to the best in Hi-Fi—at far less cost! Deluxe features include: Linear-deluxe Williamson-type circuit for flawless response; equalization for all records within ½ db of recommended accuracy; 2 exclusive new printed circuit switches in preamp section (no complex wiring to do); 3 printed circuit boards for time-saving, error-free assembly; separate, continuously variable Level and Loudness controls; use of premium 12AY7 tube for low noise and hum; DC on all filaments of preamp tubes; exclusive A-AB-B speaker selector switch (use speakers of mixed impedances without mismatch). 8 inputs: Tape Head direct; G.E. and Pickering cartridges; Ceramic cartridge; Microphone; Auxiliary; Tape Preamp; Tuner (with separate Level Set control). Power amplifier response, ± ½ db, 15-100,000 cps at full 30 watt level; distortion—harmonic, 0.55% at 30 watts—IM, 0.74% at 20 watts. Separate Bass and Treble controls; rumble filter switch; variable damping. Output, 8 and 16 ohms. With smart French-gray cabinet, 4 x 15 x 15". Ready for easy, money-saving assembly. Shpg. wt., 32 lbs.

Model Y-762. 30-Watt Hi-Fi Amplifier Kit. Net only.....**$76.95**

knight-kit High Fidelity FM Tuner Kit

Model Y-751

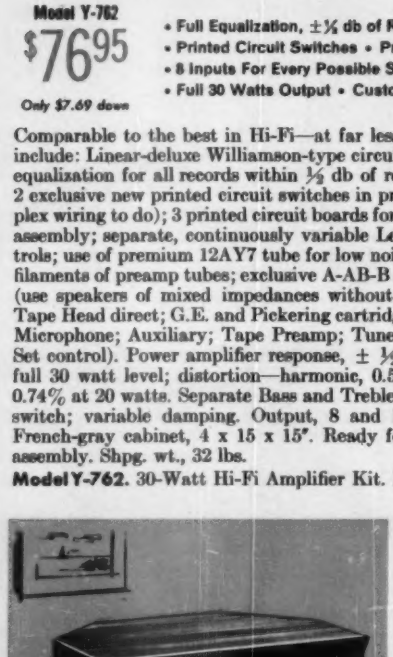
$38.95

Only $3.89 down

- Authentic High Fidelity FM Response
- Flywheel Tuning • Automatic Frequency Control
- Printed Circuit • Pre-Adjusted Coils and IF's
- 4 Microvolt Sensitivity Guaranteed

Here is top value in creative engineering, impressive hi-fi performance and distinctive design—a tuner you'll be proud to build and own. Covers the full FM band, 88 to 108 mc. Features Automatic Frequency Control (with disabling feature) to "lock-in" stations and prevent drift; Inertia Flywheel Tuning for velvet-smooth, accurate station selection; pre-adjusted RF coils; pre-aligned IF's; cascode broad-band RF amplifier; drift-compensated oscillator; neon bulb pointer. All critical wiring is already done for you in the form of a printed circuit board—assembly is simple. Sensitivity is 4 microvolts for 20 db of quieting across entire band; output, 2 volts at 1000 microvolts input; IF bandwidth, 200 kc; response, 20-20,000 cps. with only 0.6% distortion. Output jacks for amplifier and tape recorder; cathode follower output. Ideal for use with the KNIGHT-KIT amplifiers, or any amplifier with phono-tuner switch. Features custom-styled case in French-gray, with tapered chrome-finished feet, 4 x 13 x 8". Includes all parts, tubes and step-by-step instructions for easy assembly. Shpg. wt., 12 lbs.

Model Y-751. Hi-Fi FM Tuner Kit. Net only.....**$38.95**



knight-kit Deluxe 3-Way Speaker System Kit

Model Y-937

$89.50

Only $8.95 down

- Pre-Finished "Quik-Craft" Corner Enclosure
- Klipsch Designed and Licensed
- Famous Knight 12" 3-Way Speaker
- Easy to Assemble—Top Hi-Fi Quality
- Choice of Enclosure Finishes

Deluxe quality high fidelity speaker system at a money-saving low price. Easy to assemble—all you need is a screwdriver. System includes KNIGHT "Quik-Craft" corner-type folded-horn enclosure kit, and the famous-value KNIGHT 3-Way 12-inch speaker. Just assemble the enclosure—*no finishing required*—all surfaces are finished in hand-rubbed Korina blonde, mahogany or walnut. The speaker is the new 3-way type: 12" woofer cone for bass (full 1¾ pound woofer magnet), conical radiator for mid-frequencies, built-in compression-type tweeter (with wired level control and calibrated dial) for highest frequencies. Unexcelled enclosure efficiency and superb speaker performance combine to cover the whole spectrum of audible sound for true hi-fi response from 35 to 15,000 cps, ± 3 db. Kit includes 12" 3-Way speaker, prefinished enclosure panels, grille cloth, hardware and instructions. *Specify Korina blonde, mahogany or walnut when ordering.* Shpg. wt., 44 lbs.

Model Y-937. 3-Way Speaker System Kit. Net only.....**$89.50**

knight-kit 10-Watt Hi-Fi Amplifier Kit

Y-753

$23.50

$2.35 down

Low-cost, authentic hi-fi amplifier. Response, ± 1 db, 30-20,000 cps. Input for crystal phono or tuner; chrome-plated chassis is punched for preamp kit below, to permit use of magnetic phono. Only 0.5 volt drives amplifier to full output. Separate bass and treble controls. Only 1% harmonic distortion. Matches 8-ohm speaker. 7 x 13 x 6". With all parts, tubes and instructions. Shpg. wt., 13 lbs.

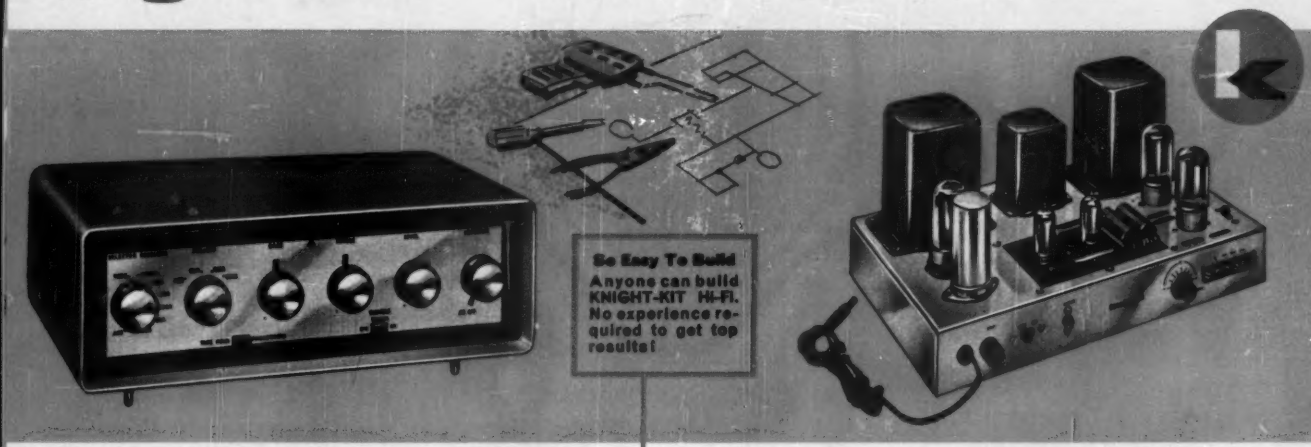
Model Y-753. Net only..**$23.50**
Y-235. Preamp Kit.....**$ 3.10**
Y-757. Metal Cover.....**$ 3.95**

ALLIED RADIO *America's Pioneer in Electronic Kits*

Fascinating ALLIED knight-kits FOR EXPERIMENTERS AND HOBBYISTS

knight-kits

THE VERY FINEST MUSICAL QUALITY—SO EASY TO BUILD
MONEY-SAVING HI-FI EVERYONE CAN AFFORD



knight-kit High Fidelity Preamplifier Kit

Model Y-754

$39.95

Only $3.99 down

- Exclusive Printed Circuit Switches and Boards
- Equalization ±½ db of Recommended Accuracy
- 8 Inputs Including Tape Head
- Self-Powered
- DC on All Tube Filaments
- Custom-Styled

Sensational Hi-Fi design at amazing low cost. Provides precise record equalization guaranteed within ½ db of recommended accuracy!—more accurate than all but the most expensive factory-built preamps. Includes exclusive new KNIGHT-KIT printed circuit switches for easy, error-free assembly; 2 printed circuit boards eliminate all other wiring, except for power supply and control leads—so easy to build. Has built-in power supply; includes premium 12AY7 and ECC82 tubes. Frequency response, ± 0.5 db, 10-50,000 cps. Has 8 inputs: Tape Head; G.E. Phono; Pickering Phono; Ceramic; Microphone; Auxiliary; Tape Preamp; Tuner. Level adjustment for tuner input. Includes separate Bass and Treble controls; separate Level and Loudness controls; Rumble Filter switch; DC on all tube filaments; cathode follower output; 2 extra AC outlets. You get every advanced hi-fi feature in this easy-to-build preamplifier at the lowest possible cost. Includes beautiful custom-styled French-gray case, with tapered chrome-finished legs, 4 x 13 x 8". With all parts, tubes, step-by-step instructions; ready for easy assembly. Shpg. wt., 12½ lbs.

Model Y-754. Hi-Fi Preamp Kit. Net only.....**$39.95**

knight-kit 25-Watt Hi-Fi Basic Amplifier Kit

Model Y-755

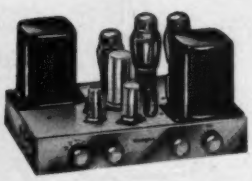
$44.50

Only $4.45 down

- Hi-Fi Response, ± 0.5 db, 10 to 120,000 cps
- Only 0.15% Distortion at 30 Watts Output
- Printed Circuit Wiring Board
- Chrome-Plated Chassis
- Williamson-Type Circuit with Over 25 Watts Output

Here's superb Hi-Fi performance at less than half the cost of a comparable commercially-assembled unit. Williamson-type linear-deluxe circuit delivers over 25 watts of virtually undistorted reproduction. Ideal for use with the KNIGHT-KIT preamp at left. Includes printed circuit board for simplified, error-free assembly. Remarkable hi-fi response, ± 0.5 db, 10-120,000 cps at 20 watts. Harmonic distortion, 0.15% at 30 watts; IM, 0.4% at 20 watts. Hum level, 85 db below 25 watts output. Output impedances, 4, 8 and 16 ohms; output tubes, 2-5881. Includes balance control for precise matching of the output tubes; variable damping control for maximum performance with any speaker system—prevents low-frequency distortion from overdamping or underdamping. Very attractive black and chrome styling, 6¼ x 14 x 9". An outstanding engineering achievement in a basic hi-fi amplifier, delivering performance equal to the finest commercially assembled units. Includes all parts and tubes; with step-by-step instructions, ready for easy assembly. Shpg wt., 25 lbs.

Model Y-755. 25-Watt Amplifier Kit. Net only.....**$44.50**
Y-759. Metal Cover for above; black finish. 5 lbs. Net.....**$4.25**



knight-kit 20-Watt Hi-Fi Amplifier Kit

Y-750

$35.75

$3.57 down

True hi-fi for less! Complete with full set of controls and built-in preamplifier. Response, ± 1 db, 20-20,000 cps; distortion 1% at 20 watts. Inputs for magnetic phono, microphone, crystal phono or recorder, and tuner. Compensation positions for 78 and LP records. Separate bass and treble controls. Output impedances, 4, 8, 16 and 500 ohms. Chrome-plated chassis. 7 x 13 x 8¾". Ready for easy assembly. Shpg. wt., 20 lbs.

Model Y-750. Net only..**$35.75**
Y-758. Metal Cover.....**$4.15**

knight-kit 2-Way Hi-Fi Speaker System Kit

Model Y-789

$49.95

Only $4.99 down

- Easy to Assemble—Pre-Finished Enclosure
- High Fidelity Response, 45 to 14,000 cps
- 12" Woofer and Horn-Type Tweeter
- A Wonderful Money-Saving Speaker Value

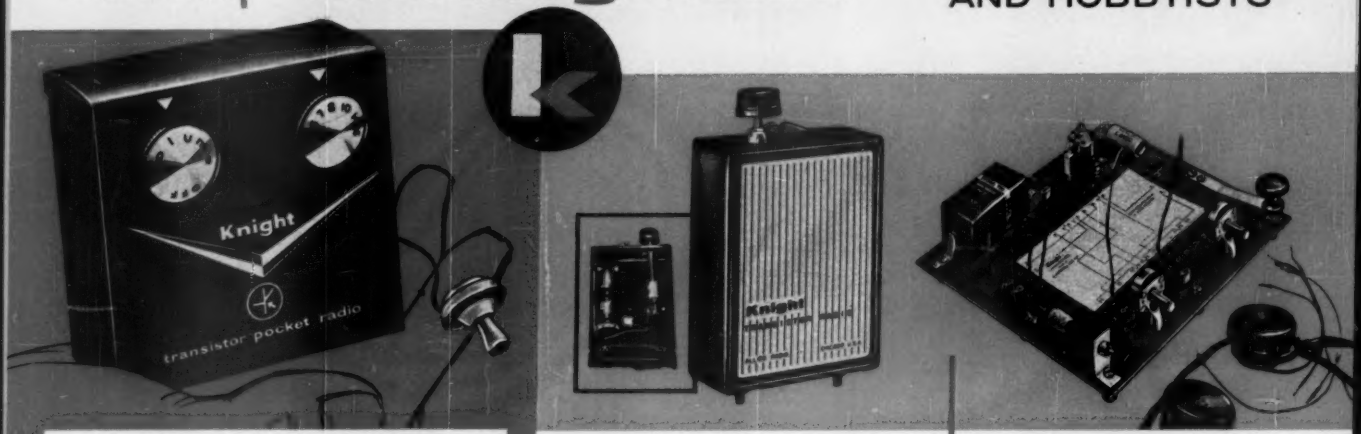
BIG SAVINGS—assemble your own quality KNIGHT-KIT 2-way speaker system—it's quick and easy! The cabinet is *pre-finished* in full-grained, high luster blonde or mahogany—you just assemble 7 pieces, mount the speaker components and enjoy rich, thrilling hi-fi sound—at incomparably low cost. Special Jensen-engineered baffle features "ducted port" construction to bring out the full beauty of bass notes, perfectly matching the Jensen woofer and compression tweeter; genuine L-pad control is rear-mounted to permit adjustment of tweeter for best tonal balance. Impedance, 16 ohms. The assembled unit delivers a frequency response of 45 to 14,000 cps. Enclosure measures 26 x 19 x 14". Beautifully styled to blend in any room. Kit includes Jensen 12" woofer, Jensen compression-type tweeter, pre-finished wood parts (with grille cloth installed), acoustic material, glue, hardware and step-by-step instructions. Absolutely no furniture finishing required. *Specify blonde or mahogany finish when ordering.* Shpg. wt., 33 lbs.

Model Y-789. 2-Way Speaker System Kit.
Net only.....**$49.95**

knight-kit HI-FI IS AVAILABLE ON EASY TERMS TO FIT YOUR BUDGET

FUN TO BUILD . . . INSTRUCTIVE . . . LATEST CIRCUITS FOR TOP PERFORMANCE
WIDEST CHOICE OF QUALITY HOBBYIST KITS

Fascinating ALLIED knight-kits FOR EXPERIMENTERS AND HOBBYISTS



knight-kit 2-Transistor Pocket Radio Receiver Kit

Model Y-262 $14.65

- Loud, Clear Local Reception
- Newest Printed Circuit Board
- Built-In Loop Antenna
- Complete Kit—Nothing Else To Buy

It's fun to build this pocket-size two-transistor radio—and you'll enjoy its crystal-clear local broadcast-band reception wherever you go! Fits in your pocket, or with its button-down flap, can be worn from your belt. Completely self-contained with built-in ferrite loopstick antenna—no external antenna needed. Extremely efficient reflex type 2-transistor circuit actually does the work of 3 transistors! Printed circuit board reduces building time to about one hour. Has air-dielectric variable capacitor for easy, accurate station tuning. Operates for months and months on long-life alkaline battery supplied. Sensitive miniature earpiece provides crystal-clear tone. Handsome tan carrying case, plastic-impregnated, is styled to resemble leather; only 4x3¾x1¾". Kit includes all parts, transistors, earpiece, battery and case. Shpg. wt., 1½ lbs.

Model Y-262. Net only $14.65

knight-kit "Trans-Midge" Transistor Receiver Kit

Model Y-767 $2.45

Tiny, cigarette-pack-size one-transistor radio kit—fascinating to build—so low-priced. This novel miniature receiver will provide endless listening pleasure the moment assembly is completed. Covers the local AM broadcast band with exceptional sensitivity and selectivity. Special features include: Efficient, slug-tuned coil for excellent station separation; external knob for easy station tuning; low-drain transistor operating for months from single penlight cell supplied; hinged-back, red plastic case. Kit includes all parts, transistor, battery, compact case and easy-to-follow instructions for quick assembly. (External antenna and headphones required.) Shpg. wt., 8 oz.

Model Y-767. Net only $2.45
J-149. 4000 Ohm Headphones. 1 lb. ... $2.15
C-100. Antenna Kit. 1½ lbs. $1.03

knight-kit 10-Circuit Transistor Lab Kit

Model Y-299 $15.75

Sensational experimenters' transistor kit—an electronic marvel! Perfect for experimenter, student or hobbyist. Assemble basic parts once, then complete project after project (10 in all), by simply plugging leads into proper jacks on printed circuit board—no wiring changes needed. You learn how transistors operate by "plugging in" to make any one of the following circuits; AM radio for strong headphone reception; 2-stage audio amplifier; wireless broadcaster; code practice oscillator; electronic timer; electronic switch; electronic flasher; photoelectronic relay; voice-operated relay; capacity-operated relay. Includes all parts, 2 transistors, battery, headphones, circuit leads, relay, photocell, special guide cards for each project, explanation of each circuit. 3 lbs.

Model Y-299. Net only $15.75

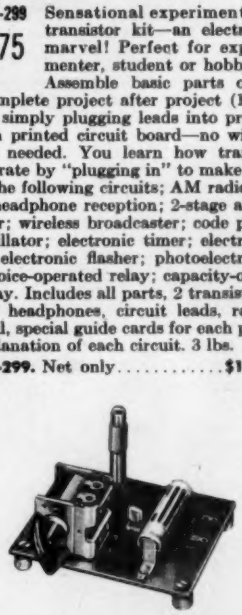
knight-kit 5-Transistor Superhet Personal Portable Radio Kit

Model Y-766 $29.95

- Styled to Equal the Finest
- Push-Pull Audio Drives 3½" Speaker
- Printed Circuit for Easy Building
- 200 Hour Battery Playing Life

Beautiful, easy-to-build transistorized personal portable with every ultra-modern design feature: 5 Texas Instrument Co. transistors; latest printed circuit chassis for easy, error-free assembly; bigger-than-average 3½" speaker; class B push-pull audio output; built-in high-gain ferrite loopstick antenna; plus phone jack output for private listening. Provides sensitive reception of the AM broadcast band with exceptional tone quality. Ultra-smart high-impact ivory plastic case has handsome gold trim with ebony accents; includes pull-out handle; only 7½x3¾x1¾". With all parts, transistors, 9 volt transistor radio battery, carrying case and instructions anyone can easily follow. Shpg. wt., 2 lbs.

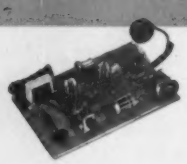
Model Y-766. Net only $29.95



1-Transistor Radio Kit

$3.95 Offers excellent AM local broadcast headphone reception. Printed circuit board for easy assembly. Operates from single penlight cell for months. Complete with all parts, transistor and penlight cell. (Antenna and headphones required.) Shpg. wt., 1 lb.

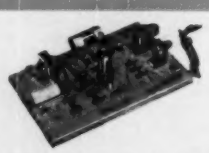
Model Y-765. Net only $3.95



"10-In-One" Electronic Lab Kit

$12.65 Famous experimenters' kit. Builds any of 10 fascinating projects, including broadcast receiver, wireless phono oscillator, code practice oscillator, signal tracer, relays, etc. Shpg. wt., 5 lbs.

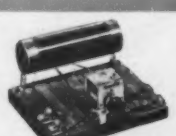
Model Y-265. Net only $12.65



"6-In-One" Electronic Lab Kit

$8.45 A favorite with beginners. After basic wiring is completed, you make circuit changes without soldering. Builds any of six favorite projects, including radio, wireless broadcaster, etc. Shpg. wt., 3 lbs.

Model Y-770. Net only $8.45



Crystal Set Hobby Kit

$2.15 Entertaining, educational. Delivers clear headphone reception of local broadcast stations. With all parts, ready for easy assembly. (Antenna and headphones required.) Shpg. wt., 1 lb.

Model Y-261. Net only $2.15

Wireless Broadcaster Kit

$9.50 Play music or make announcements through your radio set—no connection to set required! Loads of fun—easy to build. Works up to 50 feet from set. Shpg. wt., 3 lbs.

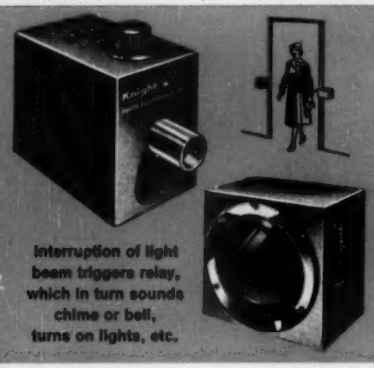
Model Y-705. Net only $9.50

ORDER FROM ALLIED RADIO 100 N. WESTERN AVE. • CHICAGO 80, ILL.

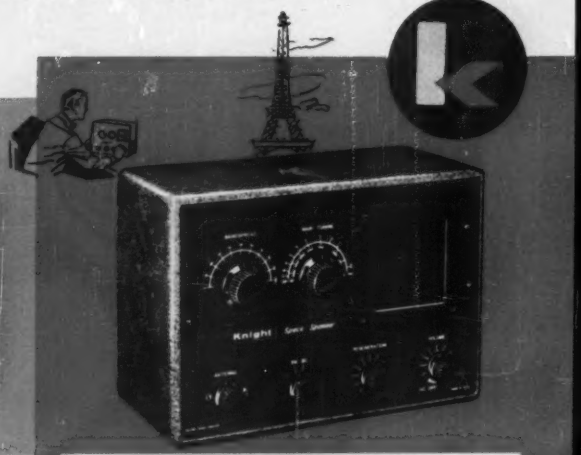
Better By Far— ALLIED knight-kit QUALITY TEST INSTRUMENTS

FUN TO BUILD . . . INSTRUCTIVE . . . LATEST CIRCUITS FOR TOP PERFORMANCE

WIDEST CHOICE OF QUALITY HOBBYIST KITS



Interruption of light beam triggers relay, which in turn sounds chime or bell, turns on lights, etc.



knight-kit Photoelectronic Relay Kit

Model Y-702 $13.50

Advanced-design, ultra-sensitive photoelectronic relay—build it yourself and save! Dozens of uses: for automatic control of lights, door announcer, burglar alarm, counting devices, etc. Provides dependable operation up to 250 feet with white light, up to 125 feet with "unseen" light (red filter) from Light Source Kit listed below. Selectable operation, with "trip" for burglar alarm to provide continuous ringing of alarm; and "auto" if relay is to operate each time beam is broken (for chimes, counting devices, turning on lights at darkness). Has SPST relay operated from thyratron; 6.3 v. terminals provide power for accessories. For 105-120 v. 50-60 cy. AC use. 6 lbs.

Model Y-702. Relay Kit. Net only . . **$13.50**

Model Y-703. Light Source Kit. With bulb and red filter. Shpg. wt., 3½ lbs. Net. **$6.75**

knight-kit "Ocean Hopper" All-Wave Radio Kit

Model Y-740 $11.95

This top-performing regenerative receiver puts a world of listening pleasure at your finger-tips. Tuning range (using coils listed below) is virtually world-wide; covers 155 kc to 35 mc, including every type of radio transmission: AM broadcast, marine, aircraft, distress channels, direction-finding, Amateur, frequency standard, foreign broadcast, and police. With bandspread tuning. For use with headphones or 3-4 ohm PM speaker. Kit is supplied with standard broadcast band coil and all tubes and parts. (Less extra coils, headphones, speaker and cabinet.) Shpg. wt., 5 lbs.

Model Y-740. Net only **$11.95**

Y-746. Cabinet for above. 1½ lbs. Net **$2.90**

Extra coils available: Long Wave Coil (155-470 kc), Net 79c. Short Wave (1.65—4.1 mc; 2.9—7.3 mc; 7—17.5 mc and 15.5—35 mc), Each 65c.

knight-kit "Space-Spanner" Bandswitching World-Wide Radio Kit

Model Y-243 $15.95

- Broadcast or Short Wave Reception
- Sensitive Regenerative Circuit
- Convenient Bandspread Tuning
- Built-In Loudspeaker

Imagine the thrill of hearing overseas broadcasts on a precision receiver you've built yourself—and then, at the flip of a switch, being able to tune to your favorite local broadcast station! Bandswitch selects exciting short wave, including foreign broadcasts, amateur calls, aircraft, police and marine radio on the 6.5 to 17 mc range, as well as standard 540-1700 kc broadcasts. Features highly sensitive regenerative circuit. Includes built-in 4" PM speaker and beam-power tube for strong volume and clear tone. Headphone connectors are available for private listening; switch cuts out speaker. Controls: Bandspread, Main Tuning, Antenna Trimmer, Bandswitch, Regeneration, Volume. 7x10x6". Easy to build from step-by-step instruction manual. For 110-120 v., 50-60 cy. AC or DC. (Less cabinet.) Shpg. wt., 5 lbs.

Model Y-243. Net only **$15.95**

Y-247. Cabinet for above. Shpg. wt. 2 lbs. Net. **$2.90**

"Ranger II" Superhet Receiver Kit

$17.25

Popular Broadcast band receiver built and enjoyed by thousands. Features built-in antenna, automatic volume control, ball-bearing tuning condenser, PM dynamic speaker. Handsome plastic cabinet. Easy to assemble. AC or DC operation. Shpg. wt., 8 lbs.

Model Y-735. Net only **$17.25**

knight-kit 2-Way Intercom System Kit

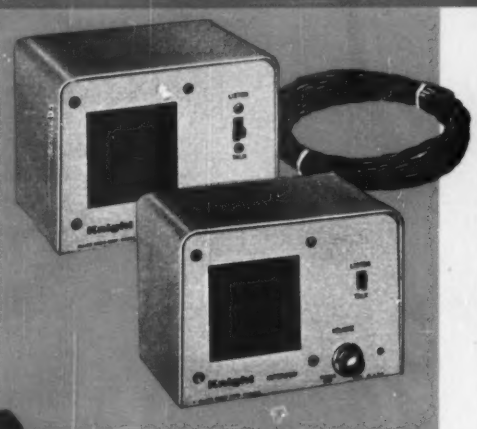
Model Y-295 $14.75

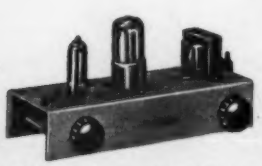
- Low Cost—Easy to Assemble
- High Gain—Clear Tone
- Handsome Metal Cabinets
- Includes 50-Foot Cable

Easy to build at lowest cost—ideal for home, office, shop or school. Consists of Master unit and Remote unit. Remote unit may be left "open" for answering calls from a distance, for "baby sitting", etc. Remote also may be set for "private" operation—cannot be "listened-in" on, but it can be called and can originate calls. Master unit includes high-gain 2-stage amplifier, combination volume control and on-off switch, plus pilot light. Each unit has 4" PM dynamic speaker. System responds to even a whisper. Handsome Antique white cabinets, each 4¾x6½x4¾". With all parts, tubes and 50-ft. cable (up to 200-ft. may be added). For 110-120 v., AC or DC. 8 lbs.

Model Y-295. Master and one Remote. Net only . . **$14.75**

Y-296. Extra Remote Station Kit. 3 lbs. **$3.75**





Phono Amplifier Kit

$9.45

Build it yourself—and save! Ideal for use in a portable phonograph—just add record player and 3-4 ohm speaker. 1½ watts output. Inverse feedback circuit. Easy to assemble. Shpg. wt., 3 lbs.

Model Y-790. Net only **$9.45**

Electronic Photoflash Kit

$28.50

Ideal for color or black and white photography. 1/700th-of-a-second flash; 50 watt/second output. Synchronizes with any camera with X or O shutter. (Less battery.) Shpg. wt., 4 lbs.

Model Y-244. Net only **$28.50**

Code Practice Oscillator Kit

$3.95

Ideal for beginners learning the code. Transistorized circuit. Operates for months from single penlight cell supplied. Clear, crisp 500 cycle tone. Jacks for headphones; screw terminals for key. 1 lb.

Model Y-239. Net only **$3.95**

Phono Oscillator Kit

$5.85

"Broadcasts" recorded music through any standard radio set up to 50 feet away. No direct connection to set required. Easy to build—fun to use. Shpg. wt., 2 lbs.

Model Y-760. Net only **$5.85**

FINEST ELECTRONIC EQUIPMENT IN EASY-TO-BUILD MONEY-SAVING KIT FORM

ADVANCED-DESIGN INSTRUMENTS FOR SERVICE, INDUSTRIAL AND RESEARCH USE IN EASIEST-TO-BUILD, MONEY-SAVING KIT FORM

Better By Far— ALLIED knight-kit QUALITY TEST INSTRUMENTS

knight-kit Low-Cost Tube Tester Kit

Model Y-143 $29.75

- With 16 Filament Voltages
- 600 Latest Tube Types Listed
- Easy-to-Read 4½" Meter
- Tests Series-String TV Tubes

Expertly designed for complete, up-to-date coverage of tube types. Tests *series-string TV tubes;* tests 4, 5, 6 and 7 pin large, regular and miniature types, octals, loctals, 9-pin miniatures and pilot lamps. Tests for open, short, leakage, heater continuity and performance (by amount of cathode emission). Big 4½" square meter has clear "GOOD-?-REPLACE" scale. With line-voltage indicator and line-adjust control. Choice of 16 filament voltages from 0.63 to 117 volts to check virtually all receiving tubes; blank socket for future type tubes. Universal-type selector switches permit selection of any combination of pin connections. Single-unit, pre-assembled 10-lever function switch simplifies and speeds assembly. Up-to-date illuminated roll chart lists over 600 tube types. Counter model case, 5 x 14 x 10". Easy to build. 14 lbs.

Model Y-143. Net only $29.75
Y-142. Portable Case model. 15 lbs. Net $34.75
Y-141. Picture Tube Adapter. 1 lb. Net ..... $ 4.25

knight-kit RF Signal Generator Kit

Model Y-145 $19.75

Build this wide-range, extremely stable RF signal generator—save two-thirds the cost of a comparable wired instrument! Large, semi-circular dial is clearly calibrated; range is covered in 5 separate bands for close accuracy in setting individual frequencies. Ideal for aligning RF and IF stages in radio and TV sets and for troubleshooting audio equipment. Delivers output on fundamentals from 160 kc all the way out to 112 mc; useful harmonics to 224 mc. Has built-in 400-cycle sine-wave audio oscillator for modulating RF; audio is also available externally. Features high-stability Colpitts circuit. Convenient jack for external modulation. Maximum audio output 10 volts; RF output over 0.1 volt on all ranges. Step and continuous-type attenuator controls. Supplied with precision-wound coils that require no adjustment. 7 x 10 x 5". Shpg. wt., 11 lbs.

Model Y-145. Net only $19.75

knight-kit 1000 Ohms/Volt VOM Kit

Model Y-128 $16.95

Exceptional accuracy and versatility at amazing low cost. Ideal for service shop, lab or Amateur use. Large 4½", 400 microamp meter with separate scales for AC and DC voltage and current, decibels and resistance. *Uses 1% precision resistors;* has 3-position function switch and 12-position range switch. *38 ranges* include: AC, DC and output volts, 0-1-5-10-50-500-5000 (1000 ohms/volt sensitivity); Resistance, 0-1000-100,000 ohms and 0-1 meg (center scale readings of 60, 150 and 1500 ohms); Current, AC or DC, 0-1-10-100 ma and 0-1 amp; Decibels, −20 to +69 in 6 ranges. Precision resistors are used as shunts and multipliers to assure exceptional accuracy of measurements. With all parts, battery, test leads and black bakelite case with convenient carrying handle, 6¾ x 5¼ x 3¾". A great value in an easy-to-build quality instrument. Shpg. wt., 2½ lbs.

Model Y-128. Net only $16.95

knight-kit Vacuum Tube Voltmeter Kit

Model Y-125 $24.95

- 200 μa Movement, 4½" Meter
- Includes AC, Peak-to-Peak
- Balanced-Bridge, Push-Pull Circuit
- 1% Film-Type Resistors

Top buy in an extremely stable, highly accurate VTVM. Easy to assemble—entire chassis is printed circuit board. Perfect for radio-TV service work, lab and Amateur use. Features low-leakage type switches; 1% film-type precision resistors; balanced-bridge, push-pull circuit (switch to any range without readjusting zero set); zero center scale and direct-reading db scale; polarity reversing switch. Ranges: Input Resistance, 11 megs; DC and AC rms, 0-1.5-5-15-50-150-500-1500; AC Peak-to-Peak, 0-4-14-40-140-1400-4000; Response, 30 cycles to 3 mc; Ohms, 0-1000-10K-100K and 0-1-10-100-1000 megs; db, −10 to +5. Includes all parts, tubes, battery, test leads and portable case, 7¾ x 5¼ x 4-½". Easy to assemble. Shpg. wt., 6 lbs.

Model Y-125. Net only $24.95
Y-126. Hi Voltage Probe; extends DC to 50,000 v. ..... $ 4.75
Y-127. Hi-Frequency Probe; extends AC to 250 mc. ..... $ 3.45

6V-12V Battery Eliminator Kit

$32.95 High current rating; continuously variable filtered output; delivers 15 amps at 6 volts, 10 amps at 12 volts. May be used as battery charger. Two meters provide simultaneous current and voltage readings. Shpg. wt., 18 lbs.

Model Y-129. Net only $32.95

Transistor Checker Kit

$8.50 Checks gain ratio of all types of transistors; checks germanium and silicon diodes; checks for continuity and shorts. A valuable instrument at very low cost. Easy to assemble. Shpg. wt., 2½ lbs.

Model Y-149. Net only $8.50

Flyback Checker Kit

$19.50 Checks condition of all types of horisontal output transformers and deflection yokes, as well as TV linearity and width coils. 4½" meter; widest range in its field. Shpg. wt., 6 lbs.

Model Y-118. Net only $19.50

Sweep Generator Kit

$43.75 Extreme linearity on a par with costly lab instruments; fundamentals to 250 mc; output flat within 1 db; electronic blanking. Easy, money-saving assembly. Shpg. wt., 16 lbs.

Model Y-123. Net only $43.75

Capacitor Checker Kit

$12.50 Tests capacitors while in the circuit! Has widest range—20 mmf to 2000 mfd. Exclusive circuit for cancelling lead capacity. "Magic Eye" indicator. Save 60% over factory-wired units. 5 lbs.

Model Y-119. Net only $12.50

ORDER FROM ALLIED RADIO 100 N. WESTERN AVE. • CHICAGO 80, ILL.

knight-kits FOR THE RADIO AMATEUR

ADVANCED-DESIGN INSTRUMENTS FOR SERVICE, INDUSTRIAL AND RESEARCH USE IN EASIEST-TO-BUILD, MONEY-SAVING KIT FORM

knight-kit 20,000 Ohms/Volt VOM Kit

Model Y-140 $29.50

Outstanding quality and performance at money-saving low price. Features 1% precision multipliers; 4½" meter accurate within 2% of full scale deflection; 50 microamp sensitivity for 20,000 ohms/volt input resistance on DC; front panel "Zero adjust"; single switch to select function and range. 32 ranges: AC, DC and output volts, 0-2.5-10-50-250-1000-5000; Resistance, 0-2000-200,000 ohms and 0-20 meg.; DC ma, 0-0.1-10-100; DC amps, 0-1-10; Decibels, −30 to +63 in six ranges. Moisture-resistant film-type resistors for extreme accuracy. Carefully engineered circuit design achieves high sensitivity and extremely versatile application. Kit includes all parts, battery, test leads and black bakelite case with highly legible white markings; size 6¾ x 5¼ x 3¾". Easy to assemble. Shpg. wt., 5 lbs.

Model Y-140. Net only.....**$29.50**

knight-kit High-Gain Signal Tracer Kit

Model Y-135 $26.50

A remarkable value in an easy-to-build instrument which permits visual and aural signal tracing of RF, IF, video and audio circuits. Has *highest gain in its price class.* Traces signal from antenna to speaker. Reproduces signal at plate or grid connection of any stage. Identifies and isolates "dead" stages. Features: usable gain of *91,000;* "magic eye" with calibrated attenuators for signal presence indication and stage-by-stage gain measurements; built-in 4" PM speaker; combination 2-position probe, one for RF (6 mmf. input), the other for audio. Provides noise test; built-in watt-meter calibrated from 25 to *1000 watts;* provision for external scope or VTVM. Binding posts provide output transformer and speaker substitution test, plus external 280 volts B+. With all parts, tubes and probe. 7x10x5". 12 lbs.

Model Y-135. Net only.....**$26.50**

knight-kit 5" Wide-Band Oscilloscope Kit

Model Y-144 $69.00

Only $6.90 down

- 5 mc Width for Color TV
- Horizontal Sweep to 600 kc
- 25 mv/inch Sensitivity
- Z-Axis Input
- Printed Circuit Construction

Equals or betters the performance of commercially wired scopes costing far more. Two printed circuit boards and laced wiring harness assure wiring accuracy and cut assembly time. Ideal for lab use, color TV servicing and high frequency applications. Wide sweep range—*15 to 600,000 cps.* Vertical response, ± 3 db, 5 cps to 5 mc; only 1 db down at 3.58 mc color burst. High vertical sensitivity of .025 rms v/inch. Input capacity, 20 mmf. Outstanding features: cathode follower inputs; 2nd anode provides 1400 volts high-intensity trace; push-pull amplifiers; positive and negative locking; frequency-compensated attenuator; Z-axis input; one volt P-P calibrating voltage; astigmatism control; retrace blanking circuit; DC positioning control. Includes CRT. 14½ x 9½ x 16". 40 lbs.

Model Y-144. Net only.....**$69.00**
Y-148. Demodulator Probe. Net.....**$ 3.45**
Y-147. Low Capacity Probe. 12 mmf. Net....**$ 3.45**

Voltage Calibrator Kit

$12.75

Permits use of any scope as precision peak-to-peak AC voltmeter. Puts a true square-wave voltage on scope screen. Selects any voltage between .01 and 100 volts; feeds external signal direct to scope for instant comparison. Shpg. wt., 5 lbs.

Model Y-136. Net only.....**$12.75**

knight-kit 5" General-Purpose Scope Kit

Model Y-145 $42.00

Only $4.20 down

- Phantastron Linear Sweep
- 25 mv/inch Sensitivity
- Printed Circuit Board
- Retrace Blanking Circuit

Feature for feature the world's best oscilloscope kit value. A standout in its class with all these fine features: *Printed Circuit* wiring board and laced harness for quick, error-free assembly. *Phantastron Sweep Circuit* for high linearity of sweep from 15 to 150,000 cps. *25 Millivolts Per Inch Sensitivity*—3 times that of similarly priced scope kits. *Calibration Voltage*—1 volt peak-to-peak square wave, fully regulated. *Vertical Amplifier*—frequency response ± 3 db, 3 cps to 1.5 mc (± 6 db to 2.5 mc). Includes: Directly coupled positioning controls; retrace blanking circuit; frequency-compensated vertical input attenuator; positive and negative internal sync; high 2nd-anode voltage for high-intensity trace; input capacity, 45 mmf. Kit includes CRT. 9½ x 13¾ x 17¾". 26 lbs.

Model Y-146. Net only.....**$42.00**

Resistance Substitution Box

$5.95

Easily determines resistor values required in a circuit. Makes available 36 standard 1-watt resistance values in 2 ranges between 15 ohms and 10 megohms, with 10% accuracy. Slide switch selects range; 18-position switch for value selection. Shpg. wt., 2 lbs.

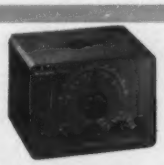
Model Y-139. Net only.....**$ 5.95**

Capacitance Substitution Box

$5.95

Makes it easy to find capacitor values needed in a circuit. Provides 18 standard values from .0001 mfd to .22 mfd, ± 20%. All values are 600 volt, except .15 and .22, which are 400 volt. 18-position selector switch. Shpg. wt., 2 lbs.

Model Y-138. Net only.....**$ 5.95**



Audio Generator Kit

$31.50

Excellent design; range, 20 cps to 1 mc; less than .25% distortion; 600 ohm output. Ideal for hi-fi testing; offers the flat response of a lab standard. Shpg. wt., 16 lbs.

Model Y-137. Net only.....**$31.50**

R/C Tester Kit

$19.50

Measures capacitance and resistance. Balanced-bridge circuit; indicates power factor; tests capacitors at rated voltage. Large, easy-to-read dial and "magic eye." Shpg. wt., 10 lbs.

Model Y-124. Net only.....**$19.50**

EASY TERMS AVAILABLE

Take advantage of the most liberal Easy Pay plan in electronics. On Knight-Kit orders totaling $45 or more—just 10% down, small monthly payments thereafter. Low carrying charges—no "red tape."

Convince yourself at no risk that CENTURY instruments are

knight-kits FOR THE RADIO AMATEUR

knight-kit All-Band Amateur Receiver Kit

Model Y-726 $104.50 — Only $10.45 down

- Tunes 540 kc to 31 mc
- Built-In Q-Multiplier
- Constant Running HF Oscillator
- Worthy of the Advanced Ham Operator
- Printed Circuit Bandswitch
- Printed Circuit Board
- 1.5 μv Sensitivity

A sensational communications receiver value with all the selectivity, sensitivity and features of high-priced commercial units. Uses printed circuitry throughout, including the exclusive new KNIGHT-KIT printed circuit bandswitch, for remarkably easy assembly. Covers 540 kc to 31 mc in 4 ranges; calibrated, electrical bandspread on 80-10 meter Ham bands; slug-tuned Hi-Q coils; continuous, VR tube-regulated B+ applied to HF oscillator lets you switch from standby to receive with no drift; built-in Q-multiplier peaks desired signal or nulls interference; delayed AVC; provision for crystal calibrator (below). Sensitivity, 1.5 microvolts for 10 db signal-to-noise ratio. Selectivity: variable from 300 cps to 4.5 kc at 6 db down. Exalted BFO injection. Controls: Main tuning, bandspread, band selector, Q-multiplier selectivity, Q-multiplier tune, null-off-peak, BFO pitch, RF gain, AF gain, BFO-MVC-AVC-ANL, off-stby-rec-cal, antenna trimmer, and phone jack. Cold-rolled ⅛" steel chassis. Handsome metal cabinet, 10 x 10 x 16½". (Less phones, 8-ohm loudspeaker and S-meter.) 23 lbs.

Model Y-726. Amateur Receiver Kit. Net..... **$104.50**

Y-727. S-Meter Kit for above. 1 lb. Net..... **$9.50**

knight-kit 50-Watt CW Transmitter Kit

Model Y-755 $38.95 — Only $3.89 down

- Ideal for the Novice
- Pi Antenna Coupler
- Bandswitching—80 to 10 Meters

There's exceptional value in this very popular bandswitching transmitter kit. Compact and versatile, it's the perfect low-power rig for the beginning novice as well as the seasoned veteran. Has bandswitching coverage of 80, 40, 20, 15 and 10 meters. Rated at 50 watts—actually operates at up to 60 watts on 80 and 40 meters. Oscillator is efficient 6AG7; final is reliable 807. Crisp, clean, cathode keying of oscillator and final. Built-in pi coupler permits use with random length antennas. Has highly effective TVI suppression. Other features not usually found in transmitter kits at this low price include: Ceramic-insulated final tank capacitor; pre-assembled switches; pre-wound parasitic chokes; ceramic coil forms; coax connector; crystal and VFO socket on front panel; power take-off jack for accessory equipment. Meter reads either plate or grid current of final. Takes crystal or VFO without circuit changes. Cabinet interior and chassis are copper-finished. Size, 8⅛ x 10½ x 8¼". With tubes and all parts for easy assembly. (Less crystal and key.) Shpg. wt., 19 lbs.

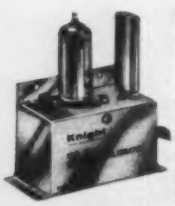
Model Y-755. 50-Watt Transmitter Kit. Net only..... **$38.95**

knight-kit Self-Powered VFO Kit

Model Y-725 $28.50 — Only $2.85 down

Complete with built-in power supply! Careful design and voltage regulation assure high stability. Excellent oscillator keying characteristics for fast break-in without clicks or chirps. Full TVI suppression. Has plenty of bandspread; separate calibrated scales for 80, 40, 20, 15, 11 and 10 meters; vernier drive mechanism. 2-chassis construction keeps heat from frequency determining circuits. Output cable plugs into crystal socket of transmitter. Output: 40v on 80, 20v on 40. With Spot-Off-Transmit switch for spot frequency tuning. Extra switch contacts for operating relays and other equipment. Attractive metal cabinet, 8¾ x 6 x 6". Ready for easy assembly. Shpg. wt., 8 lbs.

Model Y-725. VFO Kit. Net only..... **$28.50**



knight-kit 100 Kc Crystal Calibrator Kit

Model Y-256 $10.50

Crystal frequency standard at very low cost. Gives marker every 100 kc up to 32 mc. A "must" for marking band edges. Mounting flanges for installation in or back of receiver cabinet. Size only 1⅛x 1⅛x3". Requires 6.3 v. at 0.15 amp and 150-300 v. DC at 3-6 ma. Trimmer for zero-beating with WWV; On-Off switch. Complete with tube, crystal, all parts and easy-to-follow instructions. Shpg. wt., 1 lb.

Model Y-256. 100 Kc Crystal Calibrator Kit. Net only..... **$10.50**

knight-kit Amateur RF "Z" Bridge Kit

Model Y-253 $5.85

Measures standing wave ratio (SWR) and impedance of antenna systems; ideal for adjusting antenna systems for optimum results. Measures impedances from 20 to 400 ohms up to 100 mc; SWR to 150 mc. Any VOM may be used for null indicator. With coax input and output connectors. Meters both input and bridge voltage. Calibrated dial gives direct impedance reading; includes 1% precision resistor for precise calibration adjustment. With all parts and handy plasticized SWR chart (less meter). 2½ x 3 x 4½". Shpg. wt., 1½ lbs.

Model Y-253. "Z" Bridge Kit. Net only..... **$5.85**

ORDER BLANK **ALLIED RADIO** 100 N. WESTERN AVE., CHICAGO 80, ILL.

Our 37th Year

ALLIED RADIO, Dept. RE, 100 N. Western Ave., Chicago 80, Ill.

Ship me the following KNIGHT-KITS:

Quantity	Description	Model No.	Price

$.....enclosed. (For parcel post, include postage—express is shipped collect).

☐ My Down Payment in the amount of $..... is enclosed. Send Time Payment form.

Name.....

Address.....

City.....Zone.....State .....

ALL PRICES NET F. O. B. CHICAGO

FREE 1958 404-PAGE ALLIED CATALOG

See the 1958 ALLIED 404-Page Catalog for complete listings of more than 50 KNIGHT-KITS, covering Hi-Fi, Hobby, Test Instrument and Amateur Kits. The 1958 ALLIED Catalog is your complete Buying Guide to the world's largest stocks of everything in Electronics.

☐ **Send FREE 404-Page 1958 ALLIED Catalog.**

Sweep From Your Generator

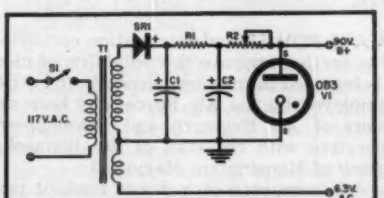
(Continued from page 47)

will be used and on which it can be mounted. However, if a separate power supply is necessary or desirable, the one shown in Fig. 4 is easy to construct and is regulated.

From the front panel, as shown in Fig. 1, the output jacks are connected across the oscillator tank in the signal generator. Use leads as short as possible for this connection. A certain amount of detuning of the generator is inevitable, but it should be kept to a minimum. Leads from the sync jacks are connected to the horizontal input of the scope. The complete alignment set-up is shown in Fig. 5.

In operating with this accessory, the generator is first set in the vicinity of the desired band of frequencies. Appropriate bandwidth is set by the sweep frequency knob. Signal strength is adjusted *via* the signal generator in the conventional manner. Frequency accuracy can be checked and adjusted by markers from another accurate generator or from some other source.

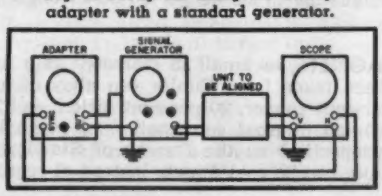
Bandwidth and uniformity of output obtained with the method shown here will not be as satisfactory as with expensive commercial generators; that is one of the drawbacks in using a reactance-tube circuit to obtain sweep output and explains why other means are generally employed in most popular sweep generators. Over the broad width required to sweep across a TV channel for alignment purposes, there would be considerable difficulty. However, this circuit is quite satisfactory for narrower bands. The author has been able to obtain 25 kc. of variation at 455 kc., which is more than enough for broadband AM alignment, at a frequency range not normally covered by service-type sweep generators. Output is also good at 4.5 and 10.7 mc. —30—



R_1—1000 ohm, 1 w. res.
R_2—10,000 ohm, 10 w. wirewound adj. res.
C_1, C_2—20 μfd., 150 v. elec. capacitor
S_1—S.p.s.t. switch
SR_1—65 ma. selenium rectifier
T_1—Any 120 volt trans. with 6.3 v., .15 amp. winding
V_1—0B3 tube

Fig. 4. Power supply for the adapter.

Fig. 5. Set-up for using the sweep adapter with a standard generator.



Convince yourself at no risk that CENTURY instruments are indispensible in your every day work.

SHIPPED ON APPROVAL
SEND NO MONEY – NO C.O.D.

Examine instruments for 10 days before you buy . . . Only then, when satisfied pay in "easy to buy" monthly installments.

Just 2 settings on the NEW FAST-CHECK TUBE TESTER

Model FC-1

tests all tubes completely, accurately and in seconds — RIGHT ON THE SPOT

The FC-1 is the only tube tester in its price range to give a complete tube test of over 600 tube types in seconds without multiple switching or annoying checking of roll charts. You make every call pay extra dividends by merely showing your customer the actual condition and life expectancy of the tube. The extra tubes you sell each day will pay for the FAST-CHECK in a very short time.

Save valuable servicing time and earn extra money with the FC-1

Model FC-1 factory wired and tested

$58.50

(factory wired only)

WIDE RANGE OF OPERATION

Checks quality of over 600 tube types, which covers more than 99% of all TV and radio tubes in use today, including the newest series-string TV tubes, auto battery-type 12 plate-volt tubes, 0Z4s, magic eye tubes and gas regulators ■ Checks for cathode-heater and cathode-grid shorts and detects inter-element leakage up to 1.5 megohms ■ Checks for life expectancy.

Model AD-1 PICTURE TUBE ADAPTER – Also available for the FC-1. Checks all picture tubes (including the new short-neck 110 degree RCA-type picture tubes) for cathode emission, shorts and life expectancy. Also rejuvenates and restores cathode emission of weak picture tubes.
Model AD-1 (factory wired only).....$4.50

OUTSTANDING VALUE FEATURES

Checks each section of multi-purpose tubes simultaneously. If one section is defective the tube will read "Bad" on the meter scale ■ 41 tube sockets accommodate all present and future tube types ■ Less than 10 seconds required to test any tube ■ Large D'Arsonval type meter is extremely sensitive, yet rugged . . . with two multi-color "Good-Bad" scales ■ Selection of 12 filament voltages ■ Line isolated ■ 7-pin and 9-pin straighteners mounted on panel ■ Large easy-to-read quick reference chart for over 600 tube types in use today ■ New tube listings furnished periodically.

Here's an in-circuit condenser tester that does the whole job!

The IN-CIRCUIT CONDENSER TESTER Model CT-1

Actually steps in and takes over where other in-circuit condenser testers fail. The tremendous range of operation makes it an absolute must for every serviceman.

Checks in-circuit: Quality . . . including leakage, shorts, opens, and intermittents ■ Value of all condensers 200 mmfd. to .5 mfd. ■ Electrolytics for quality — any size ■ Transformer, socket and wiring leakage capacity.

Checks out-of-circuit: Quality . . . including leakage, shorts, opens and intermittents ■ Value of all condensers 50 mmfd. to .5 mfd. ■ Electrolytics for quality — any size ■ High leakage to 300 megohms ■ New or unknown condensers.

JUST A FEW FEATURES OF THE CT-1

Ultra-sensitive 2 tube drift-free circuitry ■ Multi-color scale gives simultaneous readings of both quality and value in-circuit or out-of-circuit ■ Cannot damage circuits ■ Electronic eye balance indicator for even greater accuracy ■ Line isolated ■ Fully shielded.

Model CT-1K kit form **$24.95**
Model CT-W factory wired **$34.95**

CENTURY ELECTRONICS CO., INC. 111 Roosevelt Ave. Dept. 212, Mineola, N. Y.

Please rush the instruments checked for a 10 day examination period. If satisfied I agree to pay the down payment within 10 days and the monthly installments as shown. If not completely satisfied I will return the instrument within 10 days and there is no further obligation. It is understood there will be NO CARRYING CHARGES. Should I fail to make payment when due, the full unpaid balance shall become due and payable at once.

Name.....

Address.....

City.....State.....

CHECK INSTRUMENTS DESIRED

☐ Model FC-1 (wired)..... $58.50
$14.50 within 10 days. Balance $11.00 monthly for 4 months.
☐ Model CT-1W (wired)..... $34.95
$9.95 within 10 days. Balance $5.00 monthly for 5 months.
☐ Model CT-1K (kit)..... $24.95
$9.95 within 10 days. Balance $5.00 monthly for 3 months.
Prices Net F.O.B. Mineola, N. Y.

ing casting or sintering into a desired shape like the most highly coercive magnetic materials, suggested its use for

New IRC Fuse Resistors

Here's the best way to buy and stock

Low Range Resistors

The superior stability of IRC Type BW Insulated Wire Wounds has made them first choice for transistor circuits, low value dropping resistors, high stability attenuators, etc. Now IRC offers the added convenience and savings of 2 practical stocks.

NEW LOW RANGE RESIST-O-CABINETS—½ and 1 watt stocks assorted by actual usage, and covering from 0.27 to 100 ohms. You pay nothing extra for the 4-drawer metal cabinet with 28 identified compartments.

REGULAR PRICE OF THE RESISTORS INCLUDES HANDSOME METAL STOCKING CABINET!

ASSORTMENT No. 37
100 BW½ ± 10% ½ watt

QUANTITY	OHMS	QUANTITY	OHMS
3	0.27	3	3.9
3	0.33	4	4.7
3	0.39	3	5.6
3	0.47	3	6.8
3	0.56	3	8.2
3	0.68	5	10
3	0.82	3	15
4	1.0	4	22
3	1.2	4	27
3	1.5	4	33
3	1.8	5	47
4	2.2	5	56
3	2.7	3	68
5	3.3	5	100

List Price—$33.00

ASSORTMENT No. 38
75 BW-1 ± 10% 1 watt

QUANTITY	OHMS	QUANTITY	OHMS
2	0.47	2	6.8
2	0.56	2	8.2
2	0.68	4	10
2	0.82	2	15
4	1.0	2	18
2	1.2	3	22
3	1.5	3	27
2	1.8	3	33
4	2.2	2	39
2	2.7	4	47
4	3.3	3	56
2	3.9	2	68
4	4.7	2	82
2	5.6	4	100

List Price—$37.50

Order now from your IRC Distributor

Wherever the Circuit Says—

IRC

INTERNATIONAL RESISTANCE CO.
Dept. 484, 401 N. Broad St., Phila. 8, Pa.
In Canada: International Resistance Co., Ltd., Toronto, Licensee

Spot Radio News

(Continued from page 18)

between the original signal and its received echo is measured and by precise computation within the radar set, the ground speed is determined and presented on a dial. In making its computation, the radar set takes into account the angle at which the signal is beamed, the timing of the pulse, and the difference in frequency.

When two beams are used, angled forward and to the right and left of the aircraft, the readings are compared automatically and give not only true ground speed, but show wind drift (sideward slippage of the aircraft from action of the wind) in terms of drift angle.

In some systems four beams are used, angled in the form of an "X" forward and backward. By comparing the forward and backward echoes, a more accurate picture of the airplane's speed is obtained. In the comparison of forward and backward beams, any vertical motion is cancelled.

In other systems three beams are used. By processing the information received in a slightly different manner, the radar set shows vertical velocity as well as ground speed and drift angle.

Added to this basic Doppler radar are two other pieces of equipment that make the system independent of any outside sources of navigational equipment. One is the heading reference (more commonly known as the compass) and the other is a computer.

So accurate is the Doppler Navigation System that after a 1000-mile flight, an aircraft will arrive within a circle 12 miles in diameter around the destination.

A typical Doppler setup, including a computer and heading reference, should weigh between 150 and 200 pounds; such systems will be available for production in 1959.

BRITISH TELEVISION celebrated its 21st birthday recently. When the BBC began its service in 1936, there were 280 sets in the hands of the British public. By 1939, the figure had risen to 20,000. Today the number of sets in the hands of the public is nearing 8,000,000.

The British Broadcasting Corporation, the largest outside of this country, operates 18 transmitters, and is currently spending close to $30-million for system and program activities. A proportion of the tax, in the form of a license fee, paid by owners of radio and TV sets, is set aside to cover the operating expense of the BBC, which is non-commercial and accepts no advertising. At present a $25-million television headquarters is being built in West London by the BBC.

A NEW MICROWAVE POWER and attenuation certifying standard designed to further improve the reliability of electronic equipment being used in missiles, aircraft, and other defense systems employed by the Air Force, has been developed by engineers of Air Research and Development Command in cooperation with the staff of the *Weinschel Engineering Company* of Kensington, Maryland.

The new standard is composed of a direct readout precision power meter and a voltage ratio calibrator. The following capabilities can be obtained with the standard: From 100 to 4000 megacycles, a power of 25 microwatts to 2 watts, with an accuracy of ± 2 per-cent of the actual reading. From 100 to 1000 megacycles, a voltage range of from 10 microvolts to 10 volts across 50 ohms with an accuracy of ± 2 per-cent of the actual reading. From 100 to 4000 megacycles, an attenuation range of from 0 to 120 db, with an accuracy of ± .02 db per 10 db, as opposed to the usual test equipment's .04 to .50 db per 10 db throughout the range.

PERMANENT MAGNETS, as small in diameter as a human hair, have been made from Cunife (an alloy of approximately 60 per-cent copper, 20 per-cent nickel, and 20 per-cent iron, with an unusual combination of magnetic and mechanical properties) at the Bureau of Standards. The fact that Cunife can be cold drawn, instead of requir-

Model TD-55 — Terms: $6.95 after 10 day trial then $5.00 per month for 4 months.

TUBE TESTER

Model TV-40 — Terms: $3.85 after 10 day trial

ing casting or sintering into a desired shape like the most highly coercive magnetic materials, suggested its use for the very small magnet project.

Several investigators have reported on the magnetic properties of Cunife wire and on the effects of cold working and subsequent heat treatment. Their results have shown that even if the material is cold worked to the point at which the magnetic materials are adversely affected, the initial magnetic properties can be recovered or improved by a simple heat treatment or baking. These reports, however, pertained only to the larger wire sizes. No data was available on the magnetic properties of Cunife drawn to wire a few thousandths of an inch in diameter.

The Bureau's evaluation entailed cold drawing Cunife to a diameter at which its magnetic properties change and then observing the effect of various heating procedures on the restoration of magnetic properties.

Cunife is available commercially in the form of wire with a diameter of .025 inch. This wire was first cold drawn to .020 inch through Carboloy dies and further reduced to .005 inch through diamond dies. At various stages of reduction samples were cut from the coil of wire for later measurements.

Since the maximum heat-treating temperature affects the final magnetic properties several heat-treating temperatures were tried. It was found that a heat-treating temperature of between 610° and 620° C can provide a maximum value for the coercive force for all wire diameters. The final procedure adopted was to heat the wires embedded in iron filings to 610° C, to hold them at this temperature for one hour, and then allow them to cool slowly to room temperature. This technique was found to produce wire that was bright and showed no noticeable signs of surface oxidation.

THE CAA has leased, at a dollar per year for fifteen years, a giant electronic computer from the Canadian Department of Transport, for use as a dynamic operation air-traffic control simulator.

The computer, costing $5½-million, and originally designed for use as a military tactical trainer, is being converted for use in the study of day-to-day air-traffic control problems, in line with the recommendation of former Presidential Assistant Edward P. Curtis, as to enlargement of CAA simulation facilities.

In describing this unusual arrangement, CAA administrator James Pyle said that the mutual air-traffic-control problems of this country and Canada make . . . "it necessary that the air-traffic control systems . . . continue to improve on a compatible basis . . . The new computer . . . will go a long way toward keeping the makeup of the two systems (of the two countries) and procedures for using them identical. . . ."

ALTHOUGH CLOSE to 1500 applications for TV stations have been filed with the Commission since the freeze lift in April, 1952, only 486 stations are on the air today. And of that number, 398 are using the very-high bands and 88 are on the u.h.f. channels.

The gap between official approval and request for air space has been caused by the u.h.f. dilemma; originally 590 had applied for permission to use the higher bands.

The FCC now expects that u.h.f. improvements—better transmission and receiving equipment—will develop more upper-channel activity during the coming months.

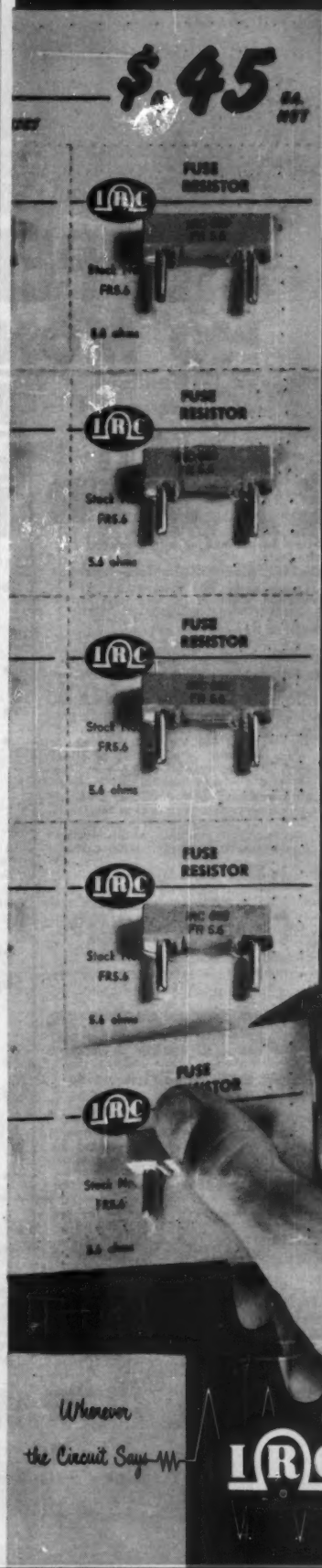
Latest formal station and new-call letter approvals by the FCC appear in this issue on page 16.

AUTOMATION—the new sparkling member of the electronics family—has become a vital asset to our economy.

So declared *RCA*'s board chairman, Brig. Gen. David Sarnoff, recently during an address in Washington. If we have the wisdom and the will to face up to our opportunities, he said, this new tool can broaden our horizons beyond all expectation.

Replying to those who picture automation as a threat of trouble, the General cited past revolutionary developments of the machine age and pointed out that they actually created more jobs than they eliminated. . . . . L. W.

New IRC Fuse Resistors



Easy To Use

IRC's new fuse resistors are rectangular-shaped, plug-in types for fast, easy replacement. Famous IRC quality in every respect.

Two Types

Popular values meet requirements of most sets. FR5.6 . . 5.6 ohms. FR7.5 . . . 7.5 ohms.

"SKIN-PACKED"
IRC fuse resistors are sheathed in protective plastic film from the moment they leave the IRC factory until you install them! Type and range are clearly identified on each card.

45c EACH
List Price: 75¢

Whenever the Circuit Says IRC

INTERNATIONAL RESISTANCE CO.
Dept. 483, 401 N. Broad St., Phila. 8, Pa.
In Canada: International Resistance Co., Ltd., Toronto, Licensee

Dept. 484, 401 N. Broad St., Phila. 8, Pa.
In Canada: International Resistance Co., Ltd., Toronto, Licensee

Model TD-55 — Terms: $6.95 after 10 day trial then $5.00 per month for 4 months.

Model TV-12 — Terms: $22.50 after 10 day trial then $10.00 per month for 5 months.

Model TV-40 — Terms: $3.85 after 10 day trial then $4.00 per month for 3 months.

Model TW-11 — Terms: $11.50 after 10 day trial then $6.00 per month for 6 months.

SHIPPED ON APPROVAL
NO MONEY WITH ORDER
NO C.O.D.

Superior's New Model TD-55

EMISSION TYPE TUBE TESTER

FOR
- **The Experimenter or Part-time Serviceman,** who has delayed purchasing a higher priced Tube Tester.
- **The Professional Serviceman,** who needs an extra Tube Tester for outside calls.
- **The busy TV Service Organization,** which needs extra Tube Testers for its field men.

Speedy, yet efficient operation is accomplished by:

1. Simplification of all switching and controls.
2. Elimination of old style sockets used for testing obsolete tubes (26, 27, 57, 59, etc.) and providing sockets and circuits for efficiently testing the new Noval and Sub-Minar types.

You can't insert a tube in wrong socket. It is impossible to insert the tube in the wrong socket when using the new Model TD-55. Separate sockets are used, one for each type of tube base. If the tube fits in the socket it can be tested.

"Free-point" element switching system. The Model TD-55 incorporates a newly designed element selector switch system which reduces the possibility of obsolescence to an absolute minimum. Any pin may be used as a filament pin and the voltage applied between that pin and any other pin or even the "top-cap."

Checks for shorts and leakages between all elements. The Model TD-55 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals. Continuity between various sections is individually indicated. This is important, especially in the case of an element terminating at more than one pin. In such cases the element or internal connection often completes a circuit.

Elemental switches are numbered in strict accordance with R.M.A. specification. One of the most important improvements, we believe, is the fact that the 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

Complete with carrying case..... **$26.95** NET

Superior's New Model TV-40

PICTURE TUBE TESTER

Not a Gadget—Not a Make-Shift Adapter, but a Wired Picture Tube Tester With a Meter for Measuring Degree of Emission—at Only $15.85

Of course you can buy an adapter for about $5—which theoretically will convert your standard tube tester into a picture-tube tester; or a neon type instrument which sells for a little more and is supposed to be "as good as" a metered instrument. Superior does not make nor do they recommend use of C.R.T. adapters or neon gadgets because a Cathode Ray Tube is a very complex device, and to properly test it, you need an instrument designed exclusively to test C. R. Tubes and nothing else.

Tests ALL magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton!!

- Tests all magnetically deflected picture tubes from 7 inch to 30 inch types.
- Tests for quality by the well-established emission method. All readings on "Good-Bad" scale.
- Tests for inter-element shorts and leakages up to 5 megohms.
- Test for open elements.

EASY TO USE: Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base (ion trap need not be on tube). Throw switch up for quality test . . . read direct on Good-Bad scale. Throw switch down for all leakage tests.

Only..... **$15.85** NET

Superior's New Model TV-12

TRANS-CONDUCTANCE TUBE TESTER

TESTING TUBES

- **Employs improved TRANS-CONDUCTANCE circuit.** An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured. This provides the most suitable method of simulating the manner in which tubes actually operate in Radio & TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading.
- **NEW LINE VOLTAGE ADJUSTING SYSTEM.** A tapped transformer makes it possible to compensate for line voltage variations to a tolerance of better than 2%.
- **SAFETY BUTTON**—protects both the tube under test and the instrument meter against damage due to overload or other form of improper switching.
- **NEWLY DESIGNED FIVE POSITION LEVER SWITCH ASSEMBLY.** Permits application of separate voltages as required for both plate and grid of tube under test, resulting in improved Trans-Conductance circuit.

Extra Feature
Model TV-12 Also Tests Transistors!

A transistor can be safely and adequately tested only under dynamic conditions. The Model TV-12 will test all transistors in that approved manner, and quality is read directly on a special "transistor only" meter scale.

The Model TV-12 will accommodate all transistors including NPN's, PNP's Photo and Tetrodes, whether made of Germanium or Silicon, either point contact or junction contact types. **$72.50** NET

Housed in hand-rubbed oak cabinet.....

Superior's New Model TW-11

STANDARD PROFESSIONAL TUBE TESTER

- Tests all tubes, including 4, 5, 6, 7, Octal, Lockin, Hearing Aid, Thyratron, Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.
- Uses the new self-cleaning Lever Action Switches for individual element testing. **Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TW-11 as any of the pins may be placed in the neutral position when necessary.**
- The Model TW-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. **Thus it is impossible to damage a tube by inserting it in the wrong socket.**
- Free-moving built-in roll chart provides complete data for all tubes. All tube listings printed in large easy-to-read type.

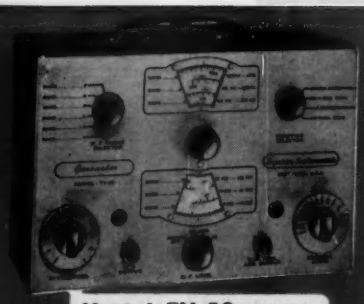
NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRAORDINARY FEATURE: SEPARATE SCALE FOR LOW-CURRENT TUBES. Previously, on emission-type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the scale. The extra scale used here greatly simplifies testing of low-current types. **$47.50** NET

Housed in hand-rubbed oak cabinet.....

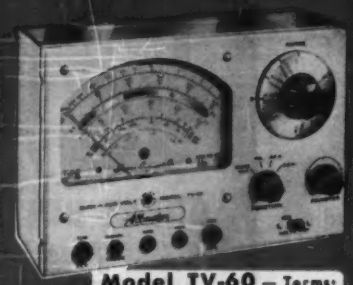
USE APPROVAL FORM ON NEXT PAGE ➡

In Canada: International Resistance Co., Ltd., Toronto, Licensee



Model TV-50 — Terms: $11.50 after 10 day trial then $6.00 per month for 6 months.

Model 76—Terms: $6.95 after 10 day trial then $5.00 per month for 4 months.



Model TV-60 — Terms: $12.50 after 10 day trial then $8.00 per month for 5 months.

TRY FOR 10 DAYS

before **you buy!** ***then*** **if satisfactory pay in easy, interest free, monthly payments. See coupon below.**

Superior's New Model TV-50

GENOMETER

7 Signal Generators in One!

- ✓ R.F. Signal Generator for A.M.
- ✓ R.F. Signal Generator for F.M.
- ✓ Audio Frequency Generator
- ✓ Bar Generator
- ✓ Cross Hatch Generator
- ✓ Color Dot Pattern Generator
- ✓ Marker Generator

R. F. SIGNAL GENERATOR: 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.
VARIABLE AUDIO FREQUENCY GENERATOR: Provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.
BAR GENERATOR: Pattern consists of 4 to 16 horizontal bars or 7 to 20 vertical bars.
CROSS HATCH GENERATOR: Pattern consists of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect.
DOT PATTERN GENERATOR (FOR COLOR TV): The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence.
MARKER GENERATOR: The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency).

Complete with shielded leads **$47.50 NET**

Superior's New Model **76**

- ✓ IT'S A **CONDENSER BRIDGE**
- ✓ IT'S A **RESISTANCE BRIDGE**
- ✓ IT'S A **SIGNAL TRACER**
- ✓ IT'S A **TV ANTENNA TESTER**

✓ **CAPACITY BRIDGE SECTION** 4 Ranges: .00001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad; .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. Will also measure the power factor of all condensers from .1 to 1000 Microfarads.

✓ **RESISTANCE BRIDGE SECTION** 2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms.

✓ **SIGNAL TRACER SECTION** With the use of the R.F. and A.F. Probes included with the Model 76, you can make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc.

✓ **TV ANTENNA TESTER SECTION** Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? Locates a break in any TV antenna and measures the location of the break in feet from the set terminals.

Complete with R.F. and A.F. probes and test leads **$26.95 NET**

Superior's New Model TV-60

20,000 OHMS PER VOLT ALLMETER

Includes services never before provided by an instrument of this type. Read and compare features and specifications below!

FEATURES

- Giant *recessed* 6½ inch 40 Microampere meter with *mirrored* scale.
- Built-in Isolation Transformer.
- Use of the latest type *printed circuit* and 1% multipliers assure unchanging accurate readings.

SPECIFICATIONS

8 D.C. VOLTAGE RANGES: (At a sensitivity of 20,000 Ohms per Volt) 0 to 15/75/150/300/750/1500/7500/30,000 Volts.

7 A.C. VOLTAGE RANGES: (At a sensitivity of 5,000 Ohms per Volt) 0 to 15/75/150/300/750/1500/7500 Volts.

3 RESISTANCE RANGES: 0 to 2,000/200,000 Ohms, 0-20 Megohms.

2 CAPACITY RANGES: .00025 Mfd. to 30 Mfd.

5 D.C. CURRENT RANGES: 0-75 Microamperes, 0 to 7.5/75/750 Milliamperes, 0 to 15 Amperes.

3 DECIBEL RANGES: —6 db to +58 db.

RF SIGNAL TRACER SERVICE: Enables following the R.F. signal from the antenna to speaker of any radio or TV receiver and using that signal as a basis of measurement to first isolate the faulty stage and finally the component or circuit condition causing the trouble.
AUDIO SIGNAL TRACER SERVICE: Functions in the same manner as the R.F. Signal Tracing service specified above except that it is used for the location of cause of trouble in all audio and amplifier systems.

Model TV-60 comes complete with book of instructions; pair of standard test leads; high-voltage probe; detachable line cord; R. F. Signal Tracer Probe and Audio Signal Tracer Probe. Pliofilm bag for all above accessories is also included. Price complete. Nothing else to buy. ONLY **$52.50 NET**

We invite you to try before you buy any of the models described on this and the preceding page. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-410, 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance or interest charges added. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

Name .....

Address .....

City ..... Zone..... State.....

All Prices net. F.O.B. N.Y.C.

- ☐ Model TW-11.....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ Model 76.....Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.
- ☐ Model TD-55.....Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.
- ☐ Model TV-50.....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ Model TV-40.....Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.
- ☐ Model TV-60.....Total Price $52.50 $12.50 within 10 days. Balance $8.00 monthly for 5 months.
- ☐ Model TV-12.....Total Price $72.50 $22.50 within 10 days. Balance $10.00 monthly for 5 months.

Available from

HARVEY'S

GREAT BRITAIN

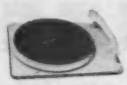
The Finest in

HIGH FIDELITY

When there is something new in Audio, you will always see it first at Harvey's. Each audio advance seems to find Harvey Radio Company right in the midst of its advancement. Probably the best example of Harvey's place in the industry is the choice of Harvey Radio as the outlet for the RCA Great Britain line.

To the high fidelity fan in England the RCA label on a high fidelity component means the ultimate in quality. Now at last, the American audio enthusiast who wants to buy superior English design in high fidelity is given the opportunity.

Take the wonderful transcription turntable unit as an example — an entirely new type of speed-change mechanism has been designed to give absolutely uniform turntable speed, while improved techniques in the construction and assembly of the motor insures reproduction free from rumble and frequency modulation. The arm and pick-up fitted to this unit are made to the highest professional standards. Price: $69.50



In the FM Tuner you will find an exactness and precision very rarely duplicated in manufacturing design. The new RCA electron-ray tuning indicator insures exact tuning for perfect response. You tune for level heights of the 2 fluorescent light bars and perfect tuning is yours. Here is the most sensitive, easy to use tuning indicator you have ever seen. Automatic Frequency Control locks in the perfect tuning permanently with an electronic lock. Price: $79.50. Powered from amplifier listed below. If purchased separately power supply is $29.00.

Then evaluate the RCA Power Amplifier and its companion equipment, the preamplifier control unit and you have a package which embodies the latest in electro-acoustic features. Just take a look at these amplifier features. A power output (20 watts; undistorted, 40 watts peak) maintained to the limits of the audible frequency spectrum. . . . Distortion at full output measurable only by the most sensitive laboratory equipment.

The companion preamplifier control unit is so designed as to provide accurate record compensation for all agreed standards. Complete mixing facilities are available for microphone, radio and tape. The output is 1.2 volts from cathode follower stage. The RCA power amplifier and preamplifier control unit are so perfectly integrated as to provide a combination that can meet any pick-up or recording requirement. Complete price for preamplifier and amplifier is $169.50.

MAIL ORDERS SHIPPED SAME DAY AS RECEIVED

30th YEAR

HARVEY Established 1927 **RADIO CO., INC.**

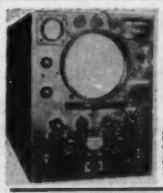
1123 Ave. of the Americas (6th Ave.)
103 West 43rd St., New York 36, N. Y.
JUdson 2-1500

New Tube Tester Data

Owners of Simpson tube checkers: Keep up-to-date with this listing of the most recent tube types.

SIMPSON MODEL 1000

Tube	Fil.	Bias	Range	Toggles	Push Buttons Shorts	Value
3BN4	2.8	7	44	041-025-500-021	AB	E
3BU8-SEC-1	3.6	40	31	020-100-430-023	ACGH	H
3BU8-SEC-2	3.6	40	31	023-100-400-023		C
4AU6	5	40	5	401-022-000-012	EFG	E
4BA6	5	14	91	401-032-000-001	EFG	E
4BE6-MIX	5	7	80	001-032-000-002	BF	E
4BE6-OSC	5	7	30	001-032-000-002		F
4BX8-TRI-1	5	19	35	240-102-400-022	ACFH	F
4BX8-TRI-2	5	10	35	240-102-400-022		A
4BZ8-TRI-1	5	15	0	200-102-400-012	ACFH	F
4BZ8-TRI-2	5	15	0	240-102-000-012		A
4DT6	5	30	70	401-022-000-023	BF	E
5CM6	5	30	52	204-105-002-001	ACI	I
5DH8-PEN	5	30	95	030-102-204-011	ACGH	F
5DH8-TRI	5	7	20	430-102-200-012		B
6BY8-PEN	6.3	15	70	400-105-220-012	CHI	G
6BY8-DIO	6.3	7	100	400-105-220-015		F
6BZ8-TRI-1	6.3	18	0	200-102-400-012	ACFH	F
6BZ8-TRI-2	6.3	18	0	240-102-000-012		A
6CQ8-TRI	6.3	70	88	242-102-004-011	CGHI	A
6CQ8-TET	6.3	70	98	242-102-004-011		F
6CR8-TRI	6.3	36	92	200-100-004-011	ACGI	A
6CR8-PEN	6.3	7	50	040-102-200-012		F
6CS7-TRI-1	6.3	7	99	304-103-400-011	CGHI	F
6CS7-TRI-2	6.3	7	40	304-103-400-011		A
6CX8-PEN	6.3	50	40	042-100-423-011	ABFH	I
6CX8-TRI	6.3	60	20	042-100-423-012		C
6CZ5	6.3	17	93	304-105-053-000	AG	I
6678/6U8-PEN	6.3	12	32	042-103-000-002	ACGH	F
6678/6U8-TRI	6.3	22	75	200-100-004-001		A
8AW8-A-PEN	10	45	80	000-100-423-021	BFGH	I
8AW8-A-TRI	10	7	35	043-100-000-002		C
8BA8-A-TRI	10	65	90	042-100-423-011	ACFH	C
8BA8-A-PEN	10	15	80	042-100-423-011		I
8BN8-TRI	10	7	85	500-105-240-012	BCHI	G
8BN8-DIO-1	10	7	100	500-105-240-015		F
8BN8-DIO-2	10	7	100	500-105-240-015		A
8SN7-TRI-1	7.5	50	16	420-420-100-012	BCEF	E
8SN7-TRI-2	7.5	50	16	420-420-100-012		B
12AJ6-TRI	12.6	25	40	401-055-200-034	AEF	G
12AJ6-DIO-1	12.6	25	20	401-055-200-005		F
12AJ6-DIO-2	12.6	25	20	401-055-200-005		E
12BL6	12.6	7	50	401-022-000-033	AG	E
12CR6-PEN	12.6	15	15	051-032-400-002	FG	E
12CR6-DIO	12.6	0	22	051-032-400-005		B
12CT8-TRI	12.6	45	19	240-103-200-012	ACGI	A
12CT8-PEN	12.6	35	83	200-103-240-011		F
12J8-TET	12.6	20	84	402-102-055-031	BCG	F
12J8-DIO-1	12.6	7	15	402-102-055-005		I
12J8-DIO-2	12.6	7	15	402-102-055-005		H
17AV5	19	7	74	410-020-020-000	CH	E
17CA5	19	50	10	041-052-200-011	AF	G
17DQ6	19	90	87	010-240-000-320	DH	J
17L6	19	70	100	013-240-000-020	DH	C
25EC6	25	70	75	010-040-020-320	CH	J
25F5	25	7	17	041-052-200-001	AF	G



LORAN APN/4 OSCILLOSCOPE

Easily converted for use on radio-TV service bench.

Completely Assembled

BRAND NEW!

Supplied with 5" Scope type 5CP1 . . . . . **$15.95**

SCR-625 MINE DETECTOR

Locates buried metal objects up to 24" or more. Detects by means of tone. Operating wt. 15 lbs. Shpg. wt. 40 lbs. **$29.50**

Complete with batteries . . . . . .

MN26Y BENDIX DIRECTION FINDER

150-325 Kc; 325-695 Kc; 3.4-7 Mc. Complete with tubes, motor. **$26.95**

BRAND NEW . . . . . .

Used, like new, incl. tubes and dynamotor . . **$18.95**

BENDIX DIRECTION FINDER

12-tube remote control Navigation Direction Finder and communications receiver. 150 to 1500 Kc in 3 bands, 28 V. DC input. Ideal for commercial navigation on boats and planes. Complete installation comprises:

MN-26-C Receiver, used, with 12 tubes **$16.50**

MN-26-C With 12 Tubes, BRAND NEW **$24.95**

MN-20-E Rotatable Loop **4.25**

MN-52 Azimuth Control Box **2.95**

All necessary accessories for above in stock.

ASB-5 'SCOPE INDICATOR

BRAND NEW, including all tubes, together with 5BP1 'Scope Tube. Originally used in Navy Aircraft RADAR equipment. Easily converted for AC operation.

VALUE $250.00!

OUR LOW PRICE $15.95

ASB-5 RECEIVER FOR 420 Mc BAND!

Complete with ten tubes: 2—955, 1—6H6, 5—6AC7, 1—6AG7, 1—6B6. **$14.95**

OUR LOW PRICE . . . . . .

Tuning Knob for ASB-5 Receiver $1.29

RADAR ANTENNA with 18" Reflector, 24 V. DC motor, position indicator, wave guides **$12.95**

BRAND NEW SPECIAL PURPOSE TUBES

In Original Individual Packing

JAN CRP-730A MAGNETRON, RAYTHEON $3.45

Type	Each	Type	Each	Type	Each
RK65	$7.25	829B	$7.95	4X7	$ .35
2J7548	.35	832A	5.95	6AG5	.33
VR105	.79	837	1.15	6J6	.33
VR150	.79	1625	.26	12SA7	.34
717A	.29	1626	.25	12SQ7	.33
815	2.99	1629	.27	35Z5	.33
826	.44	8002R	5.95	50L6	.33

NEW! Cathode Ray Tubes NEW!

3CP1	$1.18	5BP4	$2.22
3FP7	1.18	5FP2	2.45
5BP1	3.33	5FP7	1.44
		9LP7	1.88

LORAN APN-4

FINE QUALITY NAVIGATIONAL EQUIPMENT

Determine exact geographic position of your boat or plane! Complete, BRAND NEW installation consists of: ID-6B/APN-4 Indicator; R-9B/APN-4 Receiver; PE-206 Inverter; Set of Plugs; Visor for Indicator; Operation manual.

COMPLETE, BRAND NEW $129.50

SPECIAL APN-9A LORAN Receiver Indicator, less tubes, NEW (demilitarized) **$29.50**

BC-221 FREQ. METER

Special Buy! Complete with operating manual, LIKE NEW . . . . . only **$119.50**

BC-221 FREQ. METER CASE

Aluminum Case for BC-221 or TS-164 Freq. Meters. Shock Mounted. BRAND NEW **$3.99**

(add 50c for packing)

Original 1000 Kc Crystal for BC-221. BRAND NEW **$6.45**

LM FREQUENCY METER

Crystal calibrated modulated. Heterodyne. 125 Kc to 20,000 Kc. With Calibration book. Exc. Cond. **$49.50**

Less Calibration Book **$29.50**

BC-906 FREQ. METER—SPECIAL!

Cavity type, 145 to 235 Mc. BRAND NEW in original factory packing, complete with antenna. Manual included.

OUR LOW PRICE **$9.99**

ARC-5/R28 RECEIVER

2-meter Superhet. 100 to 156 Mc in 4 crystal channels. Complete with 10 Tubes.

BRAND NEW $20.45

110 V AC Power Supply Kit for above **$9.75**

ARC-5/T-23 TRANSMITTER

100-150 Mc Includes 2—832A, 2—1625 Tubes. BRAND NEW **$19.95**

SPECIAL OFFER! Limited quantity ARC-5/T23 xmitters. BRAND NEW, less tubes . . . . . **$7.95** Excellent Used, less tubes **$5.95**

ARC-5 MARINE RECEIVER-TRANSMITTER

Navy Type Comm. Receiver 1.5 to 3 Mc BRAND NEW with 6 tubes **$16.95**

Navy Type Comm. Transmitter 2.1-3 Mc BRAND NEW with 4 tubes and Xtal **$12.45**

BC-659 TRANSM. & RCVR. 27-38.9 Mc. FM. Complete with Tubes, Speaker. Used **$14.95**

Power Supply 110V 60 cy **$16.95**

SCR-274 COMMAND EQUIPMENT

ALL COMPLETE WITH TUBES Excellent Brand

Type	Description	Used	Used	NEW
BC-453	Receiver 190-550 KC..	$10.95	$12.95	$16.95
BC-454	Receiver 3-6 Mc.	7.19	8.29	11.95
BC-455	Receiver 6-9 Mc.	5.25	7.95	11.95
BC-456	Modulator	2.95	3.45	4.95
BC-450	3-Receiver Control Box . . .		1.49	1.95
BC-451	Transmitter Control Box . . .		1.25	1.49
BC-696	Xmtr 3-4-Mc (like new) . . .		6.95	8.88

BC-457 TRANSMITTER—4-5.3 Mc. complete with all tubes and crystal. BRAND NEW . . **$7.88**

BC-458 TRANSMITTER—5.3 to 7 Mc. Complete with all tubes and crystal. BRAND NEW **$7.88**

BC-459 TRANSMITTER—7-9.1 Mc. complete with all tubes and crystal. BRAND NEW **$11.95**

ARC-5/T-19 TRANSMITTER—2 to 4 Mc. BRAND NEW complete with all tubes & crystal **$8.88**

110 VOLT AC POWER SUPPLY KIT

For All 274-N and ARC-5 Receivers

Can be assembled quickly and easily, on pre-drilled chassis. Plugs into the rear of any model 274-N receiver and delivers 24 volts as well as "B" voltage. Complete kit of parts with metal case, instructions. Factory wired, tested, ready to operate **$7.95** **$11.50**

SPLINED TUNING KNOB for 274-N and ARC-5 RECEIVERS. Fits BC-453, BC-454 and others. Only **49c**

SCR-522 2-METER RIG!

Terrific buy! VHF Transmitter-receiver, 100-156 Mc. 4 channels, Xtal-controlled, Amplitude modulated voice. They're going fast! Excellent condition.

SCR-522 Transmitter-Receiver, complete with all 10 tubes, top rack and metal case.

COMBINATION . . . . . Special $33.33

Receiver only, with all tubes $19.50

Transmitter Only, with all tubes $22.25

Accessories for above available.

BC-442 ANTENNA RELAY

Wonderful Value! Consists of ¾ amp 2" RF Ammeter (antenna current indicator), 0-10 scale. Transmitter-Receiver Switching relay, in aluminum case with associated components. BRAND NEW **$2.24**

FL-8 FILTER 79c

DYNAMOTOR VALUES!

Type	Input	Output	Excellent Used	BRAND NEW
DA-19-A	28V 11A	400V .400A	$4.99	$6.95
DM-28	28V	224V .07A	2.95	4.95
DM-32A	28V 1.1A	250V .05A	2.95	5.95
DM-33A	28V 5A	575V .16A		
	28V 7A	540V .25A	1.95	3.95
DM-34D	12V 2A	220V .080A	4.25	5.50
DM-37	25.5V 9.2A	625V .225A	5.95	8.95
DM-40	14V 3.4A	172V .136A	1.75	3.45
DM-53A	28V 1.4A	220V .080A	3.95	5.95
DM-64A	12V 5.1A	275V .150A		7.95
PE-73C	28V 20A	1000V .350A	8.50	11.50
PE-86	28V 1.25A	250V .050A	2.95	5.24

BD-77C DYNAMOTOR, input: 14 V DC @ 39 A. output: 1000V DC @ .35 A. With Filter. Like New! **Special $22.50**

POWERFUL MAGNET

Fine for experimenters, research. 1800 Gauss. Weighs 16 lbs. Cobalt Steel.

OUR SPECIAL PRICE **$7.95**

SCHEMATIC DIAGRAMS For any equipment on this page, each . **50c**

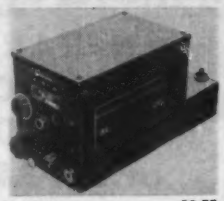
Please include 25% Deposit with order—Balance C.O.D. 50c Handling Charge on all orders under $3.00 All shipments F.O.B. Our Warehouse, N.Y.C.

G & G Radio Supply Co.

Telephone: CO 7-4605

51 Vesey St., New York 7, N. Y.

234-258 MC RECEIVER



AN/ARR-2, BRAND NEW; tubes included: 7-6001, 3—6AK5, 1—12A6. Schematic included. Complete with 11 tubes, our low price:

$9.99

With 28 V. 1.6A Dynamotor, complete **$12.95**

110 VOLT AC POWER SUPPLY KIT for above **$9.75**

ARB NAVY RCVR-XMTR

The Receiver Four band, 195 to 9050 Kc. Low Freq. Ship, Broadcast, 40 to 80 meters. Includes tubes and dynamotor for 24 V operation. Easily converted for 110 V, 12 V or 6 V. Schematic included. BRAND NEW. Overall 8¼ x 7¼ x 15¼". Wt. 30 Lbs. Complete with all tubes.

The Transmitter, tunes 3000 to 9050 Kc and 2300 to 4200 Kc. Massive, fully encased unit, complete with all tubes. Three completely integrated tuning units included. All Brand New.

The Xmitter Dynamotor has input of 27.5 V DC @ 7.4 A; output: 425 V DC @ .320 A, with Filter Base. Brand New.

Complete Assembly, OUR SPECIAL PRICE **$88.50**

RADIO RECEIVER NAVY TYPE RAY-3

Model AN-PRGN is for 14V DC operation. These receivers are supplied complete with built-in dynamotor, 11 tubes. Weston output meter on front panel, as well as coax antenna and output connection, phono jack, on-off switch.

WHILE THEY LAST . . . . . Our Price $13.95

FAMOUS BC-645 TRANSMITTER RECEIVER

BRAND NEW

Makes wonderful mobile rig for 420-500 Mc. Easy to convert for phone or CW 2-way communication. This swell rig originally cost over $1000—yours for practically a song! You get it all, in original factory carton, BRAND NEW, complete with 17 tubes, less power supply. **Conversion Instructions Included.**

Shpg. wt. 25 lbs. **$29.50**

PE-101C DYNAMOTOR for BC-645, has 12-24V input (easy to convert for 6V Battery operation) . . . . . only **$7.95**

UHF ANTENNA ASSEMBLY, for BC-645 . . . **$2.45**

Complete set of 10 Plugs for BC-645 . . . . . $5.50

CONTROL BOX for above **$2.25**

SHOCK MOUNT for above **1.25**

CONVERSION BOOKLET. Instructions for most useful surplus rigs **$2.50**

BC1206-C BEACON RECEIVER

195 to 420 Kc. made by Setchel-Carlson. Works on 24-28 volts DC. 135 Kc. IF. Complete with 5 tubes. Size 4" x 4" x 6". Wt. 4 lbs. BRAND NEW . . $8.88

Brand New, less tubes . . **$5.95**

USED, with tubes **$5.95**

USED, less tubes **2.95**

DYNAMIC HANDMIKE, with "Press-to-talk" Switch, cord and plug—BRAND NEW, only **$2.95**

DYNAMIC HEADPHONES, 600-ohm impedance, with large earphone cushions, cord and phone plug. BRAND NEW, special **$3.95**

HI-LO IMPEDANCE MATCHING TRANSFORMER for headphones, 600 ohms to 8000 ohms. With plug and jack. Instructions included. BRAND NEW. **97c**

Hi-Fi DYNAMIC HEADSET with Cushions

Freq. Range: 40-14000 CPS. No Distortion. **$6.95**

BRAND NEW . . . . . .

MICROPHONES

Model	Description	Excellent Used	BRAND NEW
T-17	Carbon Hand Mike	$5.45	$7.95
T-30	Carbon Throat Mike	.33	.79
T-45	Army and Navy Lip Mike . . .		1.33
RS-38	Navy Type	2.45	4.95
T-24	Carbon Mike		5.95
TS-9	Handset		4.95

HEADPHONES

Model	Description	Excellent Used	BRAND NEW
HS-23	High Impedance	$2.25	$4.95
HS-33	Low Impedance	2.49	4.95
HS-30	Low Imp. (featherwt.) .	1.49	2.25
H-16/U	High Imp. (2 units) . . .	3.75	7.95
CD-307A	Cords, with PL55 plug and JK26 Jack		.99

2 VOLT BATTERY "PACKAGE"

1—2V. 20 Amp. Hr. Willard Storage Battery **$2.79**

1—2V. 7 prong Synchronous Plug-in Vibrator **1.49**

1—Quart Bottle Electrolyte (for 2 cells) **1.45**

ALL BRAND NEW! Combination Price $5.45

Willard 6-Volt Midget Storage Battery

3 Amp. Hour. **BRAND NEW.** 3⅝" x 1-13/16" x 2⅜". Uses Standard Electrolyte . . . . . Only **$2.45**

OPTICAL BARGAINS

INFRARED SNIPERSCOPE TELESCOPE and PARTS

See in the dark—without being observed. War surplus Sniperscope M-2. Gov't cost about $1200. Used for industrial plant security; research lab experiments; infrared photography; spectroscopy, etc. Instrument complete, ready to use. Includes Power Pack, infrared light source. Will operate from 6 V auto battery. Battery or transformer available.

Stock No. 85,053-DU . . . Shipping weight approx. 12 lbs. $150.00 f.o.b. Barrington, N. J.

Save still more money! Build your own Sniperscope! We will furnish instructions—parts, including: Power Packs, 1P25A image tubes, light units, filters, etc. For details—request FREE Bulletin A-26-DU.

GET FREE CATALOG DU

America's No. 1 source of supply for experimenters, hobbyists. World's largest variety of Optical Items. Bargains galore. . . . War Surplus—Imported—Domestic! Microscopes, Telescopes, Satellitescopes, Color TV Tubescopes, Infrared sniperscopes and Parts, Prisms, Lenses, Reticles, Mirrors and dozens of other hard-to-get Optical Items.

WRITE FOR FREE CATALOG DU

EDMUND SCIENTIFIC CO.
BARRINGTON, NEW JERSEY

Kits for Christmas!

GENIAC COMPUTER KIT

You can construct over 50 different circuits and 40 different machines that compute, reason, solve puzzles and demonstrate a wide variety of basic computer circuits with the GENIAC electric brain construction kit. Thousands of schools, colleges, industrial firms and private individuals have bought GENIACS since we first brought them on the market.

GENIAC set up to do a problem in space ship engineering

We have recently added a circuit for composing music, which gives us special pleasure because it was designed by a 16 year old boy who learned about computers from his GENIAC. Dozens of other youngsters have created their own designs for computing circuits, used GENIACS in their school projects and established a solid foundation of information on computers with GENIACS.

Each kit comes complete with Beginners Manual, Study Guide, instructions for building all the machines and circuits, rack (exclusive with our GENIAC), parts tray, and our complete question answering service. When you buy a GENIAC you are buying a first course in computer operation.

Each kit comes with a one week money back guarantee if you are not satisfied.

Price of Kit complete with parts tray, rack, all components, manuals and texts $19.95 (postpaid in U. S., add 80c west of Mississippi). ($2.00 outside United States.)

SCIENCE KITS, Dept. RT-127
Oliver Garfield Company
126 Lexington Avenue, New York 16, N. Y.

MONEY-MAKING METERS

That's what hundreds of Mobile-Radio Engineers call their Lampkin Test Equipment!

LAMPKIN 105-B MICROMETER FREQUENCY METER. Measures all nearby crystal-controlled transmitters, 0.1 to 500 mc. No additional crystals or coils needed. Price $220.00 net.

LAMPKIN 205-A FM MODULATION METER. Measures peak FM swing ±12.5 kc. or ±25 kc. on transmitters from 25 to 500 mc. in one band. Price $240.00 net.

Wouldn't you like a *guaranteed* income in this competition-free field? To learn more, ask for free booklet, "How To Make Money in Mobile-Radio Maintenance."

MAIL COUPON TODAY!
Easy monthly payment plan available!

LAMPKIN LABORATORIES, INC.
MFM Division
BRADENTON, FLORIDA

LAMPKIN LABORATORIES, INC.
MFM Division, Bradenton, Florida
At no obligation to me, please send
☐ Free booklet ☐ Data on Lampkin meters.
Name_____
Address_____
City_____ State_____

Telemetry

(*Continued from page 73*)

analogue computers after flight for further data reduction. This method also prevents loss of data due to failure of a discriminator or recorder.

Tape recorders used in telemetry must have excellent frequency response, precise speed control, and large tape capacity. The *Ampex* Model 500[8] records four tracks on a 5000-foot reel of ½-inch wide tape with a frequency response of 100 to 120,000 cps. Tape speed is 15, 30, or 60 inches per second. A crystal oscillator provides a speed control signal which is recorded on one of the tracks. When the tape is played back this signal is fed to a servo system which, in turn, controls the speed of the tape transport capstan. Any deviation from normal speed during recording will cause the crystal signal to change frequency on the tape. On playback this signal deviation is sensed by the servo system and correction is fed to the capstan which changes speed to compensate for the original speed change during the recording of the tape.

Calibration of the station is accomplished before and after each flight. This is done by feeding known frequencies to the discriminators and recording their output on the electromechanical recorders. This provides both a discriminator and a recorder calibration.

Other Types of Systems

FM/PM telemetering is probably the most frequently used system but others have their advantages. Pulse modulation systems are being used more and more in smaller missiles and rockets as well as aircraft. Two pulse systems are: PAM (Pulse Amplitude Modulation) where the pulse height is a function of modulating voltage, and PDM (Pulse Duration Modulation) where the pulse length is modulated. These systems require more extensive ground station equipment and are more often used in conjunction with FM/PM systems than alone. Pulse modulation is bound by the limitations of commutation but is able to handle many more functions than the FM/PM system.

Other Uses

All data obtained by the forthcoming U. S. satellite will be telemetered to ground stations at several points on the earth. No other system of instrumentation could be used to record the long awaited data that these man-made moons will gather. Telemetering will be used in long-range missiles of the future to provide, among other things, information about the effects of air friction upon the skin of the missile when it re-enters the earth's atmosphere. It is expected that the missile will be heated to incandescence but the exact answer will be found in the

[8] Ampex Corporation, Redwood City, California.

Christmas Specials From Olson's Big Bargain Warehouse

New Wilcox-Gay Brand New Models TAPE RECORDERS

Model 750

Reg. $99.95
Stock No. AM-28
$69.99

YOU GET
- Push-button Keyboard
- Record Level Indicator
- Fast Rewind
- Records 2 Hours

Dual channel. Records at 7½ IPS. Takes up to 7" reels. 4 tube amplifier and built-in Alnico 5 speaker. Radio-TV-Phono jack and external speaker jack. Erases previous recording automatically when recording. Can be used as PA system with external speaker. With 3" reel of tape and 5" empty reel, microphone, cable and plug. Case with removable cover, 14x12x8".

Bone Conduction PILLOW SPEAKER

$3.07 ea.
3 For $8.50
Stock No. S-282

Amazing!! Produces no sound wave, but by-passes outer ear, conducting sound directly to inner ear by bone conduction. Produces truer sound fidelity. Eliminates listening fatigue. Imp. 3.2-4 ohms. Complete with instructions, plug and jack assembly. No ear plugs to bother with. Listen to your favorite programs without disturbing others.

OLSON Always SELLS for LESS

Send for FREE Christmas Catalog!

1,000's of items that will make wonderful gifts. Famous brand names at Big Savings

TRANSISTOR BATTERY RADIO KIT

Stock No. KB-45
$5.29 ea.
Complete with Headphone

No soldering required

Germanium diode crystal detector, transistor audio stage. Requires standard 1½ volt penlite cell. High efficiency coil and variable condenser assures sharp tuning. With headphone. Attractive plastic case, size: 5⅝ x 3¾". With detailed instructions.

"Symphony" Deluxe 10 Watt High Fidelity AMPLIFIER

Reg. $49.95
$29.95
Stock No. AM-54

- Output—10 Watts—Peak 15 Watts
- Response—20-20,000 cps
- Inputs for Radio, Tape, Phono
- Output 4, 8, 16 ohms

Olson made a tremendous buy. You save $20.00. Brand new. Equipped with built-in preamp for magnetic cartridge and complete equalization. Separate bass and treble controls, compensated volume control, selector and equalization switch. Adjustable hum control. Convenient outlet at rear of chassis. Operates on 110-120 V., 60 cy. AC.
Cage for above—**Stock No. CA-55** **$3.9**

Portable Transistor RADIO KIT

$12.94 ea.
with loudspeaker Stock No. KB-38

Build a powerful radio which will provide excellent loudspeaker reception over the entire broadcast band. Diode type detector plus dual transistor audio stages. Features built-in high-Q loop antenna and oversized PM speaker. Housed in a clear plastic case with convenient carrying handle, over all size: 7½ x 5 x 1½". Kit complete with all components and fully illustrated instructions. Less battery.
9 Volt Battery—**Stock No. BA-37** . . **Ea. 77¢**

New 1958 Monarch 4-Speed Automatic HI-FI RECORD PLAYER

Stock No. RP-37
$35.83

Tremendous value. Complete with built-in high gain amplifier and speaker. Famous Monarch changer plays all speeds and intermixes 7—10—12" records. Automatic shut-off. Dual crystal turnover cartridge. Beautifully styled portable 2-tone carrying case.
45 RPM Spindle for above—
Stock No. RP-7 . . . . . **$2.37**

Philmore "Selective" Germanium DIODE RADIO KIT

Stock No. KB-51
$3.33 ea.
3 For $9.00

Like famous crystal set but with up to date improvements such as variable capacity tuning and a high Q coil tapped at critical point for connection to xtal. Complete with headphone & instructions.

How to order from OLSON

Mail your order to 1257-T S. Forge St., Akron 8, Ohio. Send remittance with order (add for postage 5c for each dollar's worth ordered—10c for each dollar's worth if you are more than 1000 miles away). OLSON REFUNDS EVERY CENT NOT USED. Or—send no money—we'll ship C.O.D. and you pay mail or expressman for merchandise and postage. ALL MERCHANDISE 100% GUARANTEED. PLEASE—MINIMUM ORDER $5.00.

OLSON BARGAIN STORES IN

CHICAGO—623 W. Randolph St.
CHICAGO—123 N. Western Ave.
CLEVELAND—2020 Euclid Ave.
PITTSBURGH—5918 Penn Ave.
MILWAUKEE—423 W. Michigan
BUFFALO—711 Main Street

Golden Gate Eight 8" HI-FI SPEAKER

With "WHIZZER" Sound Disperser

2 For $10.00
Stock No. S-291
$5.95 ea.

The first custom designed Hi-Fidelity speaker with variable density cone and coaxial design to break the price barrier. Hi frequency whizzer cone for better dispersion of highs. Color coded voice coil binding posts. Has transformer mounting bracket. Response 40-12,000 cps. V.C. 8 ohms.

Columbia 12" LP High Fidelity RECORDS

Brand New—Full Color Jackets—NEVER BEFORE AT THIS PRICE! **$1.98 ea.** 3 For $5.00

Enjoy the best music of the greatest artists!	Stk No.
Semper Fidelis—John Philip Sousa Marches	RP-54
Teen Age Dance Party—Dan Terry Orch.	RP-57
Dance Date with Dick Jurgens	RP-57
Peggy Lee Sings with Benny Goodman	RP-58
Dinah Shore Sings Cole Porter & Richard Rogers	RP-63
Bijou Woody Herman Orch.	RP-66
Coming 'round the Mountain—Dorothy Shay, Park Ave Hillbilly	RP-70
Piano Roll Party in Hi-Fi—Lawrence Cooke	RP-83
Songs & Stories for Children	RP-86
Square Dance—Pokeberry Promenaders	RP-87
Bob Wills Special—Texas Favorites	RP-88
Music of George Gershwin—Sung by 9 top vocalists	RP-102

4" PM SPEAKER

Powered by "New Super Magnets"

Reg. $3.95 List
99c
Stock No. S-273
Lots of 6 ea. 90c

A little speaker with BIG speaker performance. Ideal for replacement in radios, TV, intercoms, & extensions. Aluminum base voice coils. Fine moisture resistant seamless ribbed cones with dust covers. Handles up to 4 watts. Impedance 3-4 ohms.

Olson Radio Warehouse

1257-T S. FORGE ST.
AKRON 8, OHIO

telemetering records of the flight.

Dummies possessing the same characteristics (*i.e.*, weight, center of gravity, internal structure, etc.) as a human body can be ejected from supersonic rocket sleds to test ejection systems and parachutes. An entire telemetering system can be placed inside the dummy to measure the effects of ejection and the shock of the parachute opening.

Another use of telemetering is remote control of natural gas and oil pipe lines. Data regarding the flow rate, temperature, pressure, density, etc., is telemetered to a master control station. Data is analyzed and control measures are telemetered back to the remote pumping stations. Thus a whole pipe line can be controlled from one point.

A manufacturer of oil well equipment designed a pressure pickup with a self-contained subcarrier oscillator (designed on RDB standards) which could be lowered into the well casing to measure underground gas pressure. The instrument was so successful that with a few modifications it could be used to measure airspeed and altitude in supersonic aircraft.

It can be seen then that telemetering has its place in many phases of the electronics industry in this age of automation. Surely it is a better system than a man with a pencil, watching one instrument and trying to put all he sees onto paper. —30—

SPOT EXTINCTION

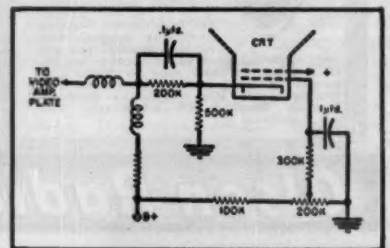
By PROF. A. V. J. MARTIN

IN SOME television receivers a white spot persists on the face of the tube for quite some time after the set has been switched off. This is due, on the one hand, to the thermal inertia of the cathode which remains hot after the set has been turned off and, on the other hand, to the charge accumulated across the high-voltage capacitors.

A very simple cure, diagrammed below, is provided by one French manufacturer. A 1 μfd. capacitor is connected between ground and the grid of the picture tube, which is cathode modulated. This capacitor charges up to a positive voltage. When the set is switched off, the cathode voltage falls rapidly to zero but the grid voltage remains positive because of the time constant due to the 1 μfd. capacitor. The positive grid then collects the electrons still emitted by the cooling cathode and prevents the white spot from appearing on the screen.

This circuit makes no claims to originality but it is certainly simple and efficient. —30—

Simple way to eliminate "spot" on the CRT.



Enjoy the Prestige of A Field Assignment with BENDIX RADIO!
ELECTRONIC FIELD ENGINEERS
Engineering degree or equivalent experience in electronic systems required.
FIELD SERVICE TECHNICIANS
technical school, plus years experience required. Military experience acceptable.
Pride in your work and your recognition in the field—that's important to the "inner man". The opportunity to advance rapidly and to grow in your profession—that's important to your future! Excellent starting salaries and field allowances—they're important to the family! You will obtain all these advantages when you choose a field assignment with the leader in its field—Bendix Radio!
Simply drop us a postal card stating education & experience. We'll arrange for a personal interview.
Address:
MR. O. A. BOWMAN
Field Engineering Dept. R
Bendix Radio
DIVISION OF BENDIX AVIATION CORP.
SMITH & GREENSPRING AVENUES
BALTIMORE 9, MARYLAND

Only from famous COYNE do you get this modern up-to-the minute TV Home Training. Easy to follow instructions—fully illustrated with 2150 photos and diagrams. Not an old Radio Course with Television tacked on. Includes *UHF* and *COLOR TV*. Personal guidance by Coyne Staff. *Practical Job Guides* to help you EARN MONEY QUICKLY IN A TV-RADIO SALES AND SERVICE BUSINESS—**part time or full time.** COSTS MUCH LESS—pay *only for training—no costly "put together kits."*

SEND COUPON FOR FREE BOOK

SEND COUPON BELOW for *Free Book* and full details including EASY PAYMENT PLAN. NO COST OR OBLIGATION—NO SALESMAN WILL CALL.

H. W. COOKE, JR. PRES. **COYNE** ELECTRICAL SCHOOL FOUNDED 1899

A TECHNICAL TRADE INSTITUTE OPERATED NOT FOR PROFIT
500 S. Paulina Dept. 97-HT5 Chicago 12, Illinois

COYNE ELECTRICAL SCHOOL
Television Home Training Div.
500 S. Paulina St., Chicago 12, Ill., Dept. 97-HT5

Send FREE BOOK and details of your Television Home Training offer.

Name_____

Address_____

City_____ State_____

Quality + Economy = No Noise
VOLUME CONTROL and CONTACT RESTORER
With Perma-Film

- Cleans
- Lubricates
- Protects

NOT A CARBON TET SOLUTION

Also available in 8 oz. bottles and quart cans At Your Nearest Distributor

2 Oz. Bottle, Net to Servicemen $1.00

6 Oz. Spray Can, Net to Servicemen $2.25

The ORIGINAL, DEPENDABLE
NO-NOISE TUNER-TONIC
With Perma-Film

BEWARE OF IMITATIONS!

- Cleans, lubricates, restores all tuners, including wafer type
- Won't change or affect capacities, inductance or resistance
- Won't harm insulations or precious metals nor attack plastics
- Eliminates all noise, oxidation and dirt indefinitely
- Use for TV, radio and FM
- Non-toxic, non-inflammable
- Insures trouble-free performance

6 oz. Aerosol Can, Net to Servicemen $3.25

ELECTRONIC CHEMICAL CORP.
813 Communipaw Avenue, Jersey City 4, N. J.

RCA McGEE SCOOP! RADIATION COUNTERS UP TO 75% OFF

NEW—GENUINE RCA

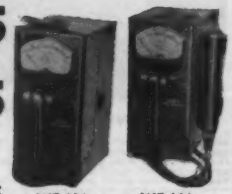
WF-10A WF-12A

Reg. $119.50 Model WF-10A .. $29.95

Reg. $149.50 Model WF-12A .. $34.95

3 RANGES

0-100—1000—10,000 COUNTS



WF-11A WF-14A

Reg. $154.50 Model WF-11A .. $37.95

Reg. $186.00 Model WF-14A .. $39.95

3 RANGES

0-200—2000—20,000 COUNTS

MODEL WF-10A *Regular $119.50* McGEE'S PRICE **$29.95**

RCA Model WF-10A, Radiation Geiger counter for amateur and professional use. Explore for Uranium or check for atomic fall-out radiation. Complete with test sample. Simple to use, weighs only 5 lbs. In aluminum case, 7¾"x8½"x3½". Indicates presence of radioactivity in 3 ways, by meter, neon light and headphones. Requires 2—67½ volt Burgess XX45 "B" batteries and 3 ±2 flashlight cells. Battery kit, $5.29 extra. 3 sensitivity ranges, 0-100, 0-1000 and 0-10,000 counts per minute. A terrific value from McGee. RCA Model WF-10A with tubes and headphones, less batteries, $29.95. Battery kit, $5.29 extra.

MODEL WF-12A *Regular $149.50* McGEE'S PRICE **$34.95**

RCA Model WF-12A, Radiation Geiger counter. Similar to WF-10A, except has an external probe. Priced with tubes and headphones at $34.95, less batteries. Kit of 2—XX45 Burgess "B," plus 3 ±2 flashlight cells, $5.29 extra.

MODEL WF-11A *Regular $154.50* McGEE'S PRICE **$37.95**

RCA Model WF-11A, Radiation Geiger counter. Explore for Uranium or check for atomic fall-out. Uses extra sensitive Bismuth tube. Test sample included. Simple to use, weighs only 5 lbs. Weatherproof case 7¾"x8½"x3½". Indicates presence of radioactivity 3 ways, by meter, neon light and headphones. Requires 2 Burgess XX45 "B" batteries and 3 ±2 flashlight cells. Battery kit $5.29 extra. 3 sensitivity ranges, 0-200, 0-2000, 0-20,000 counts per minute. A terrific value from McGee. RCA Model WF-11A, Sale price, $37.95 with tubes and headphones. Battery kit, $5.29 extra.

MODEL WF-14A *Regular $186.00* McGEE'S PRICE **$39.95**

RCA Model WF-14A, similar to Model WF-11A, except has an external probe. Priced complete with extra sensitive Bismuth tube, other tubes and headphones, $39.95 less batteries. Battery kit, $5.29 extra.

Model WF-15A

RCA REG. $475.00 SALE PRICE **$99.50**

COMPLETE WITH 10 BISMUTH TUBES

RCA Model WF-15A, Radiation Geiger counter for schools, labs, professionals, etc. A super sensitive Geiger counter with 10 Geiger counter tubes. Three counting ranges, 0-1000, 0-10,000 and 0-100,000 counts per minute. Special features include background control, battery test. Weighs only 8 lbs. Price includes all tubes, headphone and leather carrying case. Measures 11"x4⅞"x7½". Requires 2 Burgess XX45, 67½ volt "B" batteries, plus 3 ±2 flashlight cells and 1 pen cell. RCA Model No. WF-15A, with test sample. McGee's Sale price, $99.50, less batteries. Battery kit, $5.37 extra.

Model WF-16A

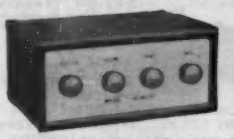
RCA REG. $750.00 SALE PRICE **$149.50**

COMPLETE WITH 10 BISMUTH TUBES

RCA Model WF-16A is the most sensitive of all, having 10 super sensitive Bismuth tubes. Measures up to 200,000 counts per minute in 3 ranges; 0-2000, 0-20,000 and 0-200,000 CPM. 2 step switch permits fast or slow meter indication. A professional Geiger counter that was priced at $750.00. Now offered by McGee for only $149.50. Weighs 8 lbs. 11"x4½"x 7½". Requires 2—XX45 Burgess 67½ volt "B," plus 3 ±2, 1½ volt flashlight cells and 1 pen cell. A terrific value for $149.50, with tubes and headphone, less batteries. Battery kit, $5.37 extra.

NEW 1958 MODEL

SLIM LINE HI-FI AMPLIFIER $34.95



SLIM LINE SL-20

16 WATTS PUSH PULL EL-84 **$34.95**

RESPONSE 15 CPS TO 22,000 CPS

ORDER WITH A SPEAKER AND SAVE

★ WITH CU-14Y 12" COAX $44.95 ★ WITH B-125X SPEAKER $51.95

★ WITH P15-CR 15" COAX 54.95 ★ WITH B-347 SPEAKER 69.95

WITH NORELCO 12" 9762-M $65.00

New, 1958 model Imperial Slim-Line 16 watt high fidelity amplifier (20 watts peak), with built-in pre-amplifier. Full range audio response from 15 to 22,000 cps. Dual tone controls; full 18 db bass and full 15 db treble boost. Input for radio tuner, tape recorder and phono. Input compensation for the new 1958 model, 4 gram General Electric variable reluctance cartridges, as well as the famous G.E. RPX-050, RPX-052 and crystal phono cartridges. 8 position selector switch selects inputs and record compensation. Compensation for AES and RIAA phono records. A factory built amplifier at less than kit prices. Output impedance matches 8 or 16 ohm high fidelity PM speakers. Price includes tubes: 2—12AX7, 1—12AU7, 2—EL-84 and 5Y3GT. Modern multi-color leatherette covered wood cabinet at no added cost; matches blond or mahogany finish speaker systems. Size: 8¼" tall, 11¼" wide, 8" front to back. Ship. wt. 15 lbs. Model SL-20 Imperial, List price $69.50. McGee's Sale price, $34.95.

SLIM LINE SL-10

12 WATTS PUSH PULL 6V6 **$24.95**

RESPONSE 20 CPS TO 17,500 CPS

ORDER WITH A SPEAKER AND SAVE

★ WITH CU-14Y 12" COAX $34.95 ★ WITH B-125X SPEAKER $41.95

★ WITH P15-CR 15" COAX 44.95 ★ WITH B-347 SPEAKER 59.95

WITH NORELCO 12" 9762-05 $49.95

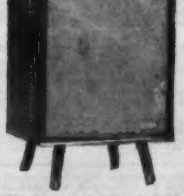
New, 1958 model Imperial Slim-Line, 12 watt high fidelity amplifier (16 watt peak), with built-in pre-amplifier. Full range audio response from 20 to 17,500 cps. Dual tone controls, full 12 db bass boost and full 15 db treble boost. Input for radio tuner or tape recorder and phono. Input compensation for the new, 1958 model 4 gram General Electric variable reluctance cartridge as well as RPX-050, RPX-052 and crystal phono cartridges. Compensation for AES and RIAA phono records. A factory built amplifier at a price you might pay for a kit that actually included less material. Output impedance matches any 8 ohm high fidelity PM speaker. Price includes tubes: 2—12AX7, 2—6V6GT and 5Y3GT. Modern multi-color leatherette covered wood cabinet, matches blond or mahogany finish speaker systems. Size: 8¼" tall, 11¼" wide and 8" front to back. Ship. wt. 12 lbs.

Model SL-10 Imperial, List price, $49.50. McGee's Sale Price, $24.95.

COMPLETE 1958 MODELS HI-FI SPEAKER SYSTEMS IN BAFFLES

"HOLLYWOOD STYLING"

AT PRICES YOU MIGHT PAY FOR AN ENCLOSURE ALONE



MODEL H-4H. 4 SPEAKER SYSTEM IN BAFFLE **$39.95**

MODEL Z-4Z SYSTEM **$49.95**

New, 1958 Hollywood 4-speaker systems are designed to give realistic reproduction from your Hi-Fi amplifier or FM-AM radio. Juke box full bass with variable brilliance control. Genuine LC crossover network built-in. Ideal for use with our Slim-Line 12 and 20 watt high Fidelity amplifiers, as well as our Espey and Hallicrafters chassis. Small in size to be attractive, yet large enough to baffle properly. Fully enclosed and acoustically lined. 25" tall, 19" deep, 25" wide. Take $3.00 discount if you order with any amplifier or the Espey chassis. Specify mahogany, walnut or blond when ordering, otherwise we will ship mahogany.

MODEL H-4H SYSTEM $39.95

Model H-4H Hollywood 4 speaker high fidelity speaker system. 20 watts, response 20 to 17,500 cps. Choice of Mahogany or Walnut or Blond finish enclosure. Features a 12" General Electric 6.8 oz. Alnico V magnet, aluminum voice coil woofer, plus 6" mid-range and 2-5" tweeters. Built-in variable brilliance L-C crossover network. Model H-4H, Ship. wt. 55 lbs. Price, $39.95.

MODEL Z-4Z SYSTEM $49.95

Model Z-4Z, Hollywood 4 speaker high fidelity speaker system. 25 watts, response from 18 to 17,500 cps. Choice of Mahogany or Walnut or Blond finish enclosure. Features a 15", 21½ oz. Alnico V Utah heavy duty woofer, plus 6" mid-range and 2-5" tweeters. Built-in variable brilliance, L-C crossover network. Model Z-4Z, Ship. wt. 57 lbs. Sale price, $49.95.

Either of above systems can be ordered in larger baffle shown at right for $5.00 extra.

IMPERIAL 80 SPEAKER **$69.95**

IMPERIAL 90 SPEAKER **$89.95**

FULL 10 CU. FT.

Choice of Blond, Mahogany or Walnut, speaker enclosure used with the 2 Imperial systems described below. Size 39" high, 24" wide and 23½" deep. Over 10 cu. ft. of volume in this fully enclosed speaker cabinet. Beautiful finish with matching grill cloth covering entire front. Speakers are mounted on a heavy plywood baffle. Enclosure is lined with an acoustical material. Speakers and crossover network are wired up, ready to connect to 8 ohm output. Mahogany shipped if no color is specified.

IMPERIAL 80 $69.95

25 watts response, 18 to 20,000 cps. A complete speaker system in the above described enclosure, ready to connect to your Hi-Fi amplifier. Built-in L-C, 3 way crossover network. Speakers included are 15", 21½ oz. Utah woofer, 8" 6.8 oz. mid-range and horn type Pioneer PT-3 tweeter. 8 ohms impedance. Stock No. Imperial 80, speaker system. Ship. wt. 80 lbs., Sale price, $69.95.

IMPERIAL 90 $89.95

Imperial 90, 30 watt speaker system with 5 speakers. Response, 18 to 20,000 cps. A complete speaker system in the above enclosure, ready to connect to the 8 ohm output of your high fidelity amplifier. Includes the 21 oz. Utah 15" woofer, two of the 8", 6.8 oz. mid-range speakers and two of the PT-3 Pioneer horn type tweeters. Built-in L-C type, 3 way crossover network. Imperial 90, speaker system. Ship. wt. 90 lbs., Sale price, $89.95.

McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY. SEND 25% OR FULL REMITTANCE WITH ORDER. BAL. SENT C.O.D.

TELEPHONE VICTOR 2-5092

1903 McGEE ST., KANSAS CITY, MISSOURI

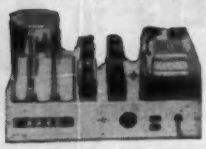
14 TUBE ESPEY HI-FI CUSTOM FM-AM CHASSIS $69.95

22 TUBE ESPEY FM-AM HI-FI TUNER-AMPLIFIER

SALE PRICE $99.95

A REGULAR $199.50 NET VALUE COMBINATION FOR $99.95

FM/AM TUNER
ESPEY 14-TUBE MODEL 700G



ESPEY 24 WATT
MODEL 501G AMPLIFIER

MODEL 700G FM-AM TUNER AND MODEL 501G AMPLIFIER

SPECIAL SALE PRICE BOTH FOR $99.95

ATTRACTIVE LEATHERETTE TUNER CABINET $7.95 EXTRA

McGee offers you both the regular $119.50, 14 tube Deluxe FM-AM tuner and the regular $79.50, 8 tube audio amplifier for the special sale price of only $99.95. The Model 700G Espey tuner has its own built in power supply. Performance features are: Sensitivity 3mv on AM, 5 mv on FM for 30 db quieting. AM selectivity 10kc at 6 db. FM 240 kc at 6db. Audio response flat from 20 cps to 20,000 cps., with less than ¼ percent distortion with one volt audio output. Chassis is 14" long, 8½" high and 10" deep. Features a one-piece molded, gold color plastic front which makes a custom installation both extremely attractive and easy at the same time. Full tuned RF stages-AFC on FM with defeating switch for easy FM tuning. Built-in preamplifier for GE or other popular variable reluctance cartridges. Three position equalizer switch for LP, AES or European records. Separate bass and treble tone controls with 23db boost. Chassis is equipped with AC outlet jacks, auxiliary input jacks for tape recorder, etc. Has built-in ferrite loop antenna for AM broadcast band and 300 ohm input for FM band. This fine quality FM-AM tuner is second to none in any of the features that you might expect of a tuner that would cost as much as $200. All of the controls are on the front panel. This is a most desirable feature when the tuner is used in conjunction with a good audio amplifier, such as the 501G which was designed with no tone control or preamplifier circuits.

The model 501G, 8 tube ultra-linear high fidelity, 24 watt audio amplifier is made to match the 700G tuner. This amplifier features less than ½ percent distortion with high fidelity response from 10 cps. to 20,000 cps. Hum level so low it can be detected by electrical instruments only. Chassis size, 12"x5"x8". Output tubes: 4—6V6GT in push-pull Williamson circuit. 6SN7GT phase inverter and 2—5V4G rectifiers. Has an 8 pound potted case output transformer with specially made grain-oriented iron core. Output impedance taps of 4, 8 and 16 ohms. This output transformer alone is a $20.00 value.

Buy both the 700G FM-AM tuner and the matching 501G amplifier for only $99.95. Tuner shipping weight 20 lbs. Amplifier shipping wt. 22 lbs. See the special deals of the 700G-501G tuner-amplifier combination with record changer and GE cartridges for extra money saving values. Also, special discount on speakers and speaker systems when ordered with your Espey tuner and amplifier.

ESPEY DEAL—1A

Espey 700G-501G tuner with 24 watt amplifier plus VM-936 GE 3 speed VM on metal base—1 Mil Diamond Needle $10.00 extra. Net $124.95

ESPEY DEAL—2

Espey 700G-501G tuner with 24 watt amplifier plus new 456 Collaro changer equipped with a GE RPX-052A cartridge. Net $144.95

ESPEY DEAL—3

Espey 700G-501G tuner with 24 watt amplifier plus Garrard RC-98 equipped with a GE RPX-052A cartridge. Net $174.95

SPEAKERS RECOMMENDED

Order any of the following speakers with your Espey tuner and amplifier:
12" coaxial PM, CU-14Y—$10.00 extra
15" coaxial PM, P15-CR—$20.00 extra
Imperial IV system—$15.00.
Imperial VI system—$25.00.
Norelco 9762—12" regularly $59.50 at $30.00 extra.
EV84—15W system—$150.00 extra.

11-TUBE FM-AM HALLICRAFTERS

HALLICRAFTERS S-78A

REGULAR $89.50 VALUE!

SALE PRICE $49.95

WITH MONARCH 4-SPEED RECORD CHANGER, 12" COAX. SPEAKER

$132.40 VALUE ALL FOR $86.95

Now, buy a complete FM-AM chassis with push-pull audio built-in, at less than you would pay for a tuner without audio amplification. We offer you this nationally known Hallicrafter S-78A, 11 tube FM-AM radio chassis complete with escutcheon plate and knobs, to be put in your own cabinet or mounted in your recreation room wall. Features a 11 tube power transformer operated superhet circuit with automatic frequency control on FM, push-pull 6K6 audio gives up to 12 watts peak output with response to 15,000 cps. Use with a good Hi-Fi PM speaker or speaker system. Output matches 3.2 or 8 ohms. Full bass boost tone control. Chassis size: 7⅞"x12½" long and 11" front to back. Input for record changer with crystal cartridge. (Self powered pre-amplifier for G.E. variable reluctance cartridge available at $2.95 extra). Model S-78A, 11 tube FM-AM chassis. Ship. wt. 22 lbs. Sale price, $49.95.
S-78A chassis with our CU-14Y, 12" coaxial PM speaker, both for $59.95.
S-78A chassis with our P15-CR, 15" coaxial PM speaker, both for $69.95.
S-78A with CU-14Y and UA8-H, 4 speed Monarch record changer with flip-over crystal cartridge, all for $86.95.
S-78A with CU-14Y and RC-88, 4 speed Garrard record changer with flip-over crystal cartridge, all for $115.95.

McGee's Famous 12 AND 15 INCH COAXIAL P.M. HIGH FIDELITY SPEAKERS

$12.95 12-Inch Model CU-14Y

$23.95 15-Inch Model P15-CR

Model CU-14Y, 12" high fidelity coaxial PM speaker. Response from 30 to 17,500 cps. Full 6.5 oz. Alnico V magnet in the 12" woofer. Special coaxially suspended high frequency tweeter. Built-in crossover network. Only two wires to connect to your radio or amplifier. Matches 3.2 to 8 ohm output. Don't confuse this speaker with many cheap speakers that are offered. This is a fine quality speaker. Stock No. CU-14Y. Sale price $12.95 each, two for $25.00.
Model P15-CR, 15" high fidelity coaxial PM speaker. Response dowe to 20 cps. and up to 17,500 cps. Full 21½ oz. Alnico V magnet in the 15" woofer. Specially made, coaxially suspended 5" high frequency tweeter. Built-in crossover network. Only two wires to connect. Matches 3.2 to 8 ohm output transformer. A regular $62.50 list speaker. Model P15-CR. McGee's Sale Price, $23.95.
McGee's new 15" Junior coaxial PM speaker. 15" woofer has 6.8 oz. Alnico V magnet. 5" coaxially suspended tweeter with crossover. Only two wires to connect to any 8 ohm radio or amplifier. Frequency response from 40 to 15,000 cps. Model No. M15-CR, 15" Junior coax PM speaker, Sale price, $16.95.

NEW 1958 MODEL— HOLLYWOOD "35"

35-WATTS RESPONSE 15 TO 22500 CPS

$39.95

- PUSH PULL EL-34
- BUILT IN PRE-AMPLIFIER
- TUNER INPUT
- 4 CONTROLS

McGee's new, 1958 "Hollywood 35." A full range, complete audio amplifier with the finest tone quality at any listening level you wish, from 1 watt to 35 watts. Full 20 db bass and treble boost tone controls. Input selector switch with record compensation. Built-in circuitry for new 460S2A G.E. phono cartridge or regular crystal cartridge. Frankly, this is all the amplifier there is, there ain't no more. 7 tubes in all. A factory built amp at a price you might pay for a kit. Ship. wt. 22 lbs. Stock No. IMP-35. List $69.50. McGee's Sale price, $39.95. Take 10% off if you order with other Hi-Fi equipment. Output impedance 4, 8 and 16 ohms for any speaker system.

VM HI-FI CHANGER. SALE PRICE $29.95 LESS BASE LESS CART.

VM-936HF $32.95

COLLARO 456 - $34.50

MONARCH UA8H $27.95

$45.90 WITH GE RPX-052A

4 Speed Monarch SALE PRICE $27.95 with 222 Ronette Ceramic Cart. Diamond 1 Mil Stylus $10.00 Extra

New offering of VM Hi-Fidelity, 3 speed record changer with or without metal base. A large special purchase makes this low sale price possible. Reg. net on VM-935 less cartridge was $38.97. Reg. net on VM-936 less cartridge was $45.47. The VM-935-936 Hi-Fi Series changers are equipped with two plug-in tone arm heads which will hold popular G.E. or Pickering single or dual play cartridges. Both have 4-pole motors for constant speed, hum free operation with a VR cartridge. Plays all 3 speeds and all 3 sizes. Will inter-mix 10" and 12" records of same speed. Shuts off after last record plays. Muting switch silences pickup during change cycle. Furnished with large 45 RPM spindle. Chassis size 13½ x 13¼ x 8½" high, 4½" above plate. Ship. wt. 12 lbs., with base 18 lbs.
VM-935HF, 3 speed Hi-Fi changer, less cartridge and base, only $29.95.
VM-935HF-GE with G.E. RPX-050A VR cartridge, $35.90.
VM-935HF-GED with "Golden Treasure" RPX-052A VR cartridge; 1 mil diamond and 3 mil sapphire styli, only $45.90.
VM-936HF, 3 speed Hi-Fi changer with metal base, less cartridge, Sale price, $32.95.
VM-936HF-GE with G.E. RPX-050A VR cartridge, $38.90.
VM-936HF-GED with G.E. RPX-052A "Golden Treasure" cartridge; 1 mil diamond, 3 mil sapphire styli, only $45.90.

4-SPEED COLLARO

Latest 1957 model RC-456, Collaro 4 speed record changer. Plays all 4 speeds, 16, 33, 45 and 78 RPM both automatically and manually. Inter-mixes records of the same speed and shuts off after last record. Fast 6 second change cycle. Automatic disengagement of idler wheels eliminates flat spots that cause wow and flutter. Base size; 13½" wide, 12" deep. 4½" above motor board and 3" below. Model RC-456 Collaro 4 speed automatic record changer, less cartridge, Sale price, $34.90. RC-456 with G.E. variable reluctance cartridge with 3 mil sapphire and 1 mil diamond stylus, Sale price, $46.95. Large 45 RPM spindle, $3.30 extra.

New Model UA8, Monarch 4 speed imported High Fidelity record changer. Features a high fidelity 4 pole motor, 9" turntable with molded rubber pallet. Counter-balanced tone arm will accept any of the popular Hi-Fi cartridges. Plays all 4 speeds and all 3 sizes. Intermixes 10" and 12" records of the same speed and shuts off after last record plays. Base size, 10⅞" x 12¾". Ship. wt. 15 lbs. Large spindle for 45 RPM records, $1.68 extra.
Model UA8-H with ±222 Ronette Hi-Fi flipover ceramic cartridge, $27.95.
Model UA8-HD, same as above but with 1 mil diamond stylus, $37.95.
Model UA8-U with ±500 Goldring variable reluctance cartridge, $39.95.
Model UA8-UD, same as above but with 1 mil diamond stylus, $39.95.

4-SPEED WEBCOR

New, 4 speed Model 152, Webcor "Magic-Mind" automatic record changer. Complete with G.E. RPX-050A variable reluctance cartridge. Plays all 4 speeds, 16, 33, 45 and 78 RPM automatically. 7", 10" and 12" LP records can be inter-mixed. Magic-Mind feature will switch speeds automatically between 33 and 45 RPM depending on the size of the record. Has heavy 4 pole motor and 8" turntable with rubber pad. Shuts off after last record plays and has neutral position to prevent flat spots on drive wheels that cause wow and flutter. Base size, 13⅜"x13". Ship. wt. 13 lbs. Sale price, $31.95. Large 45 RPM spindle, $2.94 extra.

3-SPEED VM

VM-956GE, 3 speed automatic record changer with G.E. RPX-050A variable reluctance cartridge and metal base. Plays all 3 speeds; 33, 45 and 78 RPM and all 3 size records. Will inter-mix 10" and 12" records of the same speed. Shuts off after last record. Has heavy 4 pole motor. Base size, 13-3/16"x 11⅞" deep. 7¼" high. Ship. wt. 15 lbs. Sale price, $29.95. Large 45 RPM spindle $1.62 extra.

ALLIANCE "IT" T.V. TUNER REMOTE CONTROL

REG. $19.50 LIST

McGee Special Purchase Sale! Alliance "IT" remote tuner for your TV set. A small battery operated motor turns your tuner clockwise or counter-clockwise. Attractive bakelite case fits palm of your hand. Made to sell at over $14.00 dealers net. McGee offers them for $4.94, 3 for $12.50 with flashlight batteries. Also adaptable to many other uses. Add 40c per unit for packing and postage.

McGEE'S SALE PRICE $4.94

3 for $12.50

McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY
SEND 25% OR FULL REMITTANCE WITH ORDER. BAL SENT C.O.D.

TELEPHONE VICTOR 2-5092
1903 McGEE ST., KANSAS CITY, MISSOURI

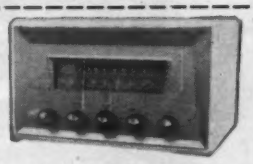
14 TUBE ESPEY HI-FI CUSTOM FM-AM CHASSIS $69.95

★ PUSH-PULL 6V6 OUTPUT
★ TWIN CONE CONTROLS
★ INPUTS FOR CRYSTAL OR V.R. PHONO, TAPE OR TV
★ WILLIAMSON TYPE CIRCUIT
★ ULTRA-LINEAR RESPONSE

MODEL HF-250C. A FULL HIGH FIDELITY AUDIO AMPLIFIER AND FM-AM TUNER—ALL ON ONE CHASSIS

REGULAR $119.50 VALUE

SALE PRICE **$69.95** LESS SPEAKER AND CABINET



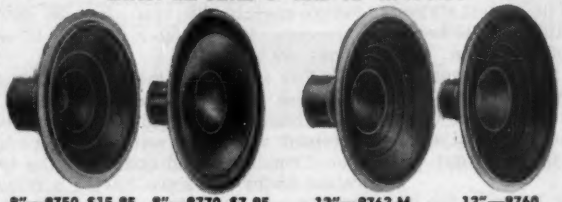
LEATHERETTE COVERED CABINET $7.85 EXTRA

Espey Model HF-250C, 14 tube FM-AM chassis with push-pull 6V6, 10 watt audio. A true Hi-Fidelity receiver built by a nationally famous maker of fine custom chassis. Ultra-linear output used in Williamson type circuit gives frequency response of 10 to 22,000 cps. Output taps of 4, 8, and 16 ohms. Separate RF stages for FM and AM assure high sensitivity. Temperature compensated FM front end for minimum drift. Separate bass and treble tone controls. Pre-amp for all types of magnetic cartridges. 2nd input for crystal phono, tape recorder or TV. 3 position equalizer for accurate reproduction of all records. Built-in antennas for both FM and AM. Response plus or minus 1 db from 10 to 22,000 cps. Harmonic distortion less than 1%. Sensitivity: FM, 8 mv for 30 db quieting; AM, 75 mv for 6 db signal to noise ratio. Off-on-volume and equalizer are combined on a concentric control. Has 2 AC outlets on rear of chassis. Beautiful edge lighted flywheel inertia slide rule dial. Size: 7¾"x13½"x10" deep. Ship. wt. 24 lbs. (not mailable). Model HF-250C Sale price, $69.95. Espey chassis with our P15-CR, 15" coaxial PM speaker, both for $89.95. Espey chassis with $84.98 list, model 9760M, 12" Phillips speaker, both for $89.95. Espey chassis with $99.95 list, model 9762M, 12" Phillips speaker, both for $104.95.

Beautiful moderntone tan leatherette covered cabinet to house the HF-250C Espey chassis for custom installations. Also, will fit the 500G Espey tuner shown on the opposite page. High quality, sturdy plywood cabinet expertly covered with modern tan leatherette material. Size, 18" long, 8½" high and 10¾" deep. Stock No. LEC-50. Custom leatherette covered cabinet. Ship. wt. 7 lbs. Order with your Espey chassis for only $7.95 extra.

SAVE ON NORELCO SPEAKERS AT McGEE

LATEST IMPORTED 8" AND 12" HI-FI PM's



8"—9750 $15.95 8"—9770 $7.95 12"—9762-M 12"—9760

The choice of Hi-Fi PM speakers, imported from Holland. Made by the internationally famous Phillips company. Twin cones are operated by the same super high efficiency Alnico magnet. The small center cone extends the audio range and loudness above 10,000 cps. Better and more natural sound reproduction. Extra number of gauss means more bass efficiency.

World Famous Hi-Fi	Imported From Holland
12" Model 9762-M	reg. $59.97 Sale Price $39.95
12" Model 9760	reg. $32.97 Sale Price $19.95
8" Model 9750	reg. $22.17 Sale Price $15.95
8" Model 9770	reg. $ 9.90 Sale Price $ 7.95

NORELCO Model 9762—12" wide range Hi-Fi PM speaker, res. 35 to 18,000 cps at 30-watts. Voice Coil imp. 8 ohms—new Alnico VI magnet gives 11,000 gauss. Regular $59.97 net, on sale at McGEE for only $39.95.
NORELCO Model 9760—12" wide range Hi-Fi PM speaker, res. 35 to 18,000 cps at 30-watts. Voice coil imp. 8 ohms—new Alnico VI magnet gives 8,000 gauss. Regular $32.97 net, on sale at McGEE for only $19.95.
NORELCO Model 9750—8" wide range Hi-Fi PM speaker, res. 50 to 20,000 cps at 10-watts. Voice coil 8 ohms—New Alnico VI magnet gives 13,500 gauss. Regular $22.17 net, on sale at McGEE for only $15.95; or 2 for $30.00.
NORELCO Model 9770—8" wide range Hi-Fi PM speaker, res. 75 to 19,000 cps. New Alnico VI magnet gives 11,000 gauss. Reg. $9.90 net, on sale at McGEE for only $7.95; or 2 for $15.00.

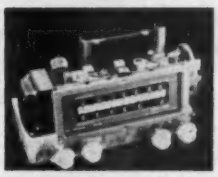
McGEE Hi-Fi SCOOP!

GROMMES 20-PG 20-WATT WITH NORELCO 12" HI-FI ALL FOR..... **$89.95**

20-PG AND P15-CR-'COAX' 89.95
20-PG AND B-347 SPEAKER 99.95
20-PG AND WF15R-HNLC-SPKR. .. 109.95

Grommes 20-PG, 20 watt High Fidelity audio amplifier. Response from 27 to 20,000 CPS. With charcoal and brass trim case, 12¾" x 4¾" x 9" deep. Tubes: 3—12AX7, 2—6L6GB and 5U4GB rectifier. Output impedances 4, 8 and 16 ohms. Rumble and scratch filter. Inputs for tuner, tape, crystal or magnetic phono. Loudness, treble and bass controls. A full 20 watt amplifier at the price that you might pay for a 10 or 15 watt size.

20-PG Grommes amplifier with 9762-05, 12" Norelco PM speaker, both for $89.95.
20-PG Grommes amplifier with P15-CR, 15" coaxial PM speaker, both for $89.95.
20-PG Grommes amplifier with B-347, 5-way Hi-Fi speaker system, both for $99.95.
20-PG Grommes amplifier with WF15R-HNLC speaker system, all for $109.95.



8-TUBE FM-AM $34.95

REGULAR $59.95 VALUE
ONLY 200 TO SELL
JACKSON FA-8C WITH 12" COAX $44.95

Model FA8C, Jackson 8 tube FM-AM custom chassis. Receives broadcast 540 to 1600 kc. and FM 88 to 108 mc. 9" etched glass slide rule dial. Chassis 7" x 13" x 7" high. Full superhet circuit with AVC. Complete with tubes: 12AT7, 6BE6, 2—6BA6, 6AL5, 6AT6, 6AQ5 and 6X4. Output matches 3.2 or 8 ohm speaker. Input for crystal pickup with radio-phono switch on front of chassis. Full size "High Q" ferrit loopstick antenna mounted on chassis. Separate antenna for FM. Bass boost tone control. Knobs, escutcheon, diagram and instructions included. Model FA8C, 8 tube FM-AM radio chassis. Ship. wt. 12 lbs. Sale Price, $34.95. Model FA8C with CU-14Y, 12" coaxial PM speaker, both for $44.95.

RADIO NEWS SPECIAL

JUKE BOX $42.95

• 15" SUPER WOOFER • HORN TWEETER • LC CROSSOVER

Radio News Special. Matched speaker system for 8 ohm output tap of your high fidelity amplifier. You get $52.85 worth of speakers at our low price of only $42.95. Up to a $90.00 value if purchased elsewhere. 1500 cycle LC crossover network, plus horn type tweeter and 35 watt, 15" Utah, regular $60.00 list, 2 lb., magnet, 2" voice coil woofer. This system will give realistic audio response. Mount in any good baffle and you have it. It's about all there is, there ain't no more. McGee's fall special for Radio & TV News, only $42.95. Stock No. WF15R-HNLC, 35 watt speaker system. Response 15 to 20,000 cps.

1958 MODEL Speaker Systems ON BAFFLE BOARDS — SALE PRICE $18.95

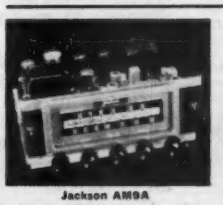
Model B-125-X, high fidelity 15-watt, 5-way speaker system, mounted on an 18" square baffle board. Has 12" High Efficiency woofer, 2—4 x 6" mid-range speakers, plus a 4" high-range and 3" tweeter; all with Alnico V magnets. Built-in LC crossover network with variable brilliance control. Ship. wt. 11 lbs. Stock No. B-125-X, 5-way, 15-watt Hi-Fi speaker system. AUDIOPHILE VALUE $30.00. SALE PRICE, $18.95.

Model B-347, high fidelity 30-watt, 5-way speaker system, mounted on a 30"x24" baffle board. Has 15" UTAH 31½-oz. woofer, 2-new high fidelity extended range 6x9" speakers, plus 2-5" tweeters; all with Alnico V magnets. Built-in LC crossover network with variable brilliance and presence controls. Ship. wt. 32 lbs. Stock No. B-347, 5-way, 30-watt Hi-Fi speaker system. AUDIOPHILE VALUE $59.95. SALE PRICE, $39.95. SALE PRICE $39.95

Mount these Hi-Fi speaker systems in your own cabinet or use for custom installation. Ideal for use with any radio or amplifier. Completely wired, with only 2-wires to connect to any 8-ohm output. (Take 10% discount if ordered with any radio or amplifier listed hereon.) Grill cloth, 75¢ extra.

FAMOUS 12" NORELCO PM SPEAKER
MODEL 9762-05 REGULAR NET WAS $59.97 — McGEE SCOOP PRICE $29.95

McGee Scoop. Genuine Norelco 9762-05 extended range high fidelity 12" PM speaker. 11,000 gauss. Heavy 37 oz. Alnico V magnet. Rated 20 to 30 watts audio. Response 35 to 18,000 cps. Regular $60.00 net value. Has extended range bakelite dispersion feature built-in center of cone to extend high frequency range. Never before have we had such a terrific value on this genuine Norelco 12" speaker. Made in Holland. Stock No. 9762-05. McGee's Sale Price, $29.95.



Jackson AM9A

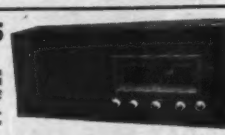
9-TUBE HI-FIDELITY

12 Watts Audio Dual Tone Controls **$29.95** LESS SPEAKER

RECEIVES BROADCAST 550 TO 1650 K.C.

Jackson AM9A, 12 watt hi-fi audio amplifier and broadcast tuner combined. Less than you would pay for the amp alone. Push-pull 6V6's. Response 30 to 15,000 cps. Inputs for crystal or v.r. phono and crystal or dynamic mike. Separate base boost and treble tone controls, radio-phono switch. Heavy duty 150 mil power trans. 9½" illuminated slide rule dial. 3 gang condenser with tuned R.F. and loop ant. Receives 550 to 1650 kc. Size, 13" x 9½" x 6" high. With tubes: 2—6BA6, 6AU6, 6BE6, 6SN7, 6AT6, 2—6V6 and 5Y3. Knobs, escutcheon, diagram and instructions included. Model AM9A. Ship. wt. 19 lbs. Sale price, $29.95. CU-14Y 12" coax speaker, $10.00 extra; 15" coax speaker, $20.00 extra.

9 TUBE—12 WATT HI-FI 8" PM—LEATHERETTE CAB. **$44.95**



9 tube high fidelity AM9A chassis shown above in leatherette covered cabinet with 8", 8.8 oz. PM speaker having tweeter cone in the center of large cone. Tan leatherette covered cabinet 10" x 10" x 24" long. Plastic grill cloth covers entire front. Stock No. CAM-98. Ship. wt. 28 lbs. Sale price, $44.95.

GOLDRING V. R. CARTRIDGE

WITH 2 SAPPHIRE STYLII $5.95
WITH 1 MIL DIAMOND, 3 MIL SAPH., $13.95

McGee offers the internationally famous Goldring variable reluctance phono cartridge, made in England and sold throughout the world to those who want the finest and most accurate music reproduction from 33⅓, 45 and 78 RPM high fidelity phono records. (Input gain and compensation similar to G.E. v.r. cartridge required.) Furnished as standard equipment with sapphire 1 and 3 mil styli. A regular $9.90 net item on sale at McGee for $5.95. For $13.95 with a diamond 1 mil stylus. These are the latest production, individually cartoned turnover cartridge with mounting bracket. Fits tone arms on most changers. Made for and bearing the famous Wilcox-Gay Recordio name. No. 546 Goldring V.R. (Wilcox-Gay) cartridge, Net $5.95. No. DS46-05, Goldring V.R. (Wilcox-Gay) cartridge with diamond 1 mil stylus, $13.95. 1 mil diamond stylus for Goldring V.R. cartridge, purchased separately, $9.95.

McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY. SEND 25% OR FULL REMITTANCE WITH ORDER. BAL. SENT C.O.D.

TELEPHONE VICTOR 2-5092
1903 McGEE ST., KANSAS CITY, MISSOURI

BASIC ELECTRICITY
BASIC ELECTRICITY
Brand New!
No matter what part of radio, electronic, communications or electrical work you plan to do, this is the most important training of all.

Complete training in

BASIC ELECTRICITY

Your key to Success in Radio-Electronics

All electrical equipment from industrial units to TV sets; from guided missile controls to hi-fi systems are based on the same fundamental electrical principles.

Learn these principles thoroughly . . . and then everything else comes 10 times as easy!

You'll understand new circuits and new equipment in a jiffy. You'll have a firm grasp of ALL electrical-electronic matters that will amaze you. And you'll be far better fitted for interesting, good-paying jobs along almost any electrical line.

Rufus Turner's new 396-page BASIC ELECTRICITY manual brings you the kind of practical training that can pay off in a dozen different ways!

From basic currents and circuits to electromagnetism . . . from polyphase systems to oscilloscopes . . . right down the line to transistors, tubes, sound reproduction and even telemetering, BASIC ELECTRICITY covers the entire field.

TRAINING THAT SHOWS YOU HOW!

300 pictures make things doubly clear!

You get practical examples of reactance, phase relations, impedance . . . even power factor. You see how and why to make measurements by various methods. "Set up" diagrams teach you to extend meter ranges or to measure speed, strain, thickness, etc. Essentials such as motors, generators, batteries, etc., are fully covered. Complicated controls are explained . . . with no need for advanced mathematics to understand them.

Send coupon! You be the judge without risking a cent!

Includes BASIC ELECTRONICS

. . . general and industrial . . . even covers transistors and their uses.

BRINGS YOU THE COMPLETE "KNOW HOW" OF; Circuits & Currents; Controls; Electromagnetism; Capacitance; Inductance; Resistance; Phase Relations; Generators; Motors; Transformers; Rectifiers; Wiring; Illumination; Instruments & Measurements; Tubes; Amplifiers; Oscillators; Transistors; Industrial Electronics & Automation; X-Rays; Power Factor; Servos . . . and dozens more.

10-DAY FREE EXAMINATION

Dept. RH-127, RINEHART & CO., INC.
232 Madison Ave., New York 36, N. Y.

Send Turner's 396-page BASIC ELECTRICITY manual for 10-day FREE EXAMINATION. If book is satisfactory, I will then send you $6.50 (plus postage) promptly in full payment. If not, I will return book within 10 days and owe nothing. *(SAVE! Send $6.50 with order and we pay postage. Same 10-day return privilege with money refunded.)*

Name .....

Address .....

City, Zone, State .....

OUTSIDE U.S.A.—Price $7.00 cash with order. Money back if you return book within 10 days.

most equal to the emitter current. The base current, being the difference between emitter and collector currents ($I_b = I_e - I_c$) will generally be very small. Since power gain is maximum at 1.5 −2 ma., most stages will operate in this region. Actually, you may find some operating points down to .5 ma. without having serious losses of gain. An easy way to measure emitter current in most circuits is to measure the voltage drop across either the emitter resistor (or possibly a collector resistor) and to calculate currents by Ohm's Law.

With the exception of output stages, when a stage is found to operate below or above the range of .5 −2 ma., it is fairly certain from a d.c. standpoint that that stage is inoperative. Note: Care should be taken to measure these currents in the absence of signal since, in a.v.c.-controlled stages, current will vary with signal.

Assume the trouble to be in the oscillator section of the converter. This would be the case where an i.f. signal can be passed through the mixer, but an r.f. signal does not produce the necessary i.f. to get a signal through. In that case, it should be determined whether the oscillator is operating at all. In the case of the single-stage converter of Fig. 1, any a.c. vacuum-tube voltmeter (such as the *Hewlett-Packard* 400C, D, or H or the *Ballantine* Models 310-A or 314) that is sensitive enough to measure down to 50 mv. can be connected to the emitter of the converter transistor. However, since these instruments are generally not used in service work, one can utilize a regular service v.t.v.m. on its lowest a.c. r.m.s. scale.

Since the local oscillator operates from about .99 to 2.1 mc., the v.t.v.m. should be used in conjunction with an r.f. probe. The presence or absence of oscillator injection voltage can, however, be determined without the use of an r.f. probe.

The proper magnitude of oscillation should be somewhere between 50 and 500 millivolts r.m.s., and oscillation must be present over the entire broadcast band. (This can be checked quite easily by rotating the variable capacitor from end to end.) No voltage at this point, the converter emitter, indicates the absence of oscillator injection and an ohmmeter check of the oscillator coil should divulge the culprit.

To troubleshoot or align a transistor radio, it is generally helpful to know how much signal strength should be applied at a given stage in order to evaluate gain. The following is a measurement procedure suitable for this purpose:

1. An a.c. vacuum-tube voltmeter should be connected across the speaker terminals.

2. Applying the signal at any test point, the generator attenuator should be adjusted to get a .13 or .4 volt r.m.s. reading on the output v.t.v.m. (Since most speaker voice-coil impedances are 3.2 ohms, this would mean that the reference output power is either $P = V^2/Z = .13^2/3.2 = 5$ mw. or $P = .4^2/3.2 = 50$ mw. In various subminiature sets, however, the voice-coil impedance is about 16 ohms, in which case the reference a.c. voltage becomes, for 5 mw. reference: $V = \sqrt{5 \times 10^{-3} \times 16}$ or approximately .28 volt. For 50 mw. reference, $V = \sqrt{50 \times 10^{-3} \times 16}$ or about .89 volt.

3. The signal can then be applied at any base in the manner described.

In this technique, some idea can be obtained as to the sensitivity, operational condition, and quality of the receiver under test since, having a reference power output, it now suffices to read the input voltage from the generator to obtain an idea of the receiver sensitivity at any point. This assumes the use of audio and r.f. generators having calibrated and metered attenuators. In the absence of this type of equipment, two very simple attenuators can be built—one for the r.f.-i.f. generator (Fig. 6) and the other for the audio signal (Fig. 7). The attenuation thus made possible will permit the injection of small signals into any circuit under test while the relatively insensitive v.t.v.m. conveniently measures r.m.s. voltages 10 or 100 times larger!

In making sensitivity and gain checks, one further note is worth consideration: Since absolute sensitivity will vary from set to set, this type of test gives only a relative indication of the order of magnitude of gain or sensitivity. Even a 5 to 1 deviation from the figure given in Table 1 can be normal in some cases. However, when deviations larger than 10 to 1 are encountered, the indication of trouble is quite strong.

During alignment, a 455-kc. i.f. signal should be applied to the antenna secondary and the i.f. transformer is then peaked for maximum output on the v.t.v.m. across the voice coil. After alignment, the sensitivities given in Table 1 are a good guide to what should be found in the receiver. Alignment of the converter stage is so similar to that used for vacuum-tube converters that no elaboration of this procedure should be necessary. —30—

Table 1. Reference signal levels for gain checks in transistor radios.

Receiver	Audio-Output Stage Base	Audio Driver Base	Detector Base	2nd I.F. Base	1st I.F. Base	Converter Base
6-transistor*	150 mv.	2.5 mv.	50 mv.	2.5 mv	50-100 μv.	5-10 μv.
5-transistor	20 mv.	5 mv.	50 mv.	2.5 mv.	50 μv.	5-10 μv.
4-transistor	20 mv.	.5 mv.	5-10 mv.	——	200 μv.	10-20 μv.

* Reference output is 50 mw., all others 5 mw.

SYNCHROS, SELSYNS, AUTOSYNS!!!

At Money-saving prices!!! **LARGE QUANTITY 20,000 in stock**

110 V. 60 Cycle Units

Size & Type	Approx. Wt. lbs.	Approx. length (in.)	Approx. Dia. in.	Price Used	Price New
5G Navy	5	6.0 - 6.8	3.4 - 3.6	$5.00	$20.00
5F Navy	5	6.0 - 6.8	3.4 - 3.6	5.00	none
5DG Navy	5	6.0 - 6.8	3.4 - 3.6	5.00	none
5CT Navy	5	6.0 - 6.8	3.4 - 3.6	5.00	none
XV CT Army	5	6.0 - 6.8	3.4 - 3.6	none	20.00
Sperry 78360 Brass Case	voltage TR. 8	6.0 - 6.8	4.3 - 3.6	none	20.00
Sperry 78359 Brass Case	voltage REC. 8	6.0 - 6.8	4.3 - 3.6	none	20.00

CT-Control Transformer: D-Differential Motor: DG-Differential Generator: F-Motor (Follower): G-Generator. Mfgd. by Bendix, Ford Instrument Co. and General Electric. Specify. Bendix, Ford and GE in stock.

G-E SELSYN 2J1G1—$4.95 PR.

Brand new small size Selsyns for beam direction indicator and other devices. 57.5 volt 400 cycle. Connect rotors in series on 115 V. Will operate for intermittent duty on 60 cycles, approx. size 2¼" dia. x 4½" long. Shpg. wt. 3 lbs. per pair.
Sale Price.....pr. $4.95

TU-10-B TUNING UNITS—$2.50 ea.

Used in the BC-375 transmitter, but the most favorable and acceptable piece of surplus gear for obtaining good cheap useable parts. The TU-10-B contains three double spaced transmitting type variable condensers of 16, 27, and 7 plate varieties, 3 mica transmitting type micas, 2 isolantite shaft couplings, antenna coupling switch, two precision vernier dials, chokes, inductances and other useful parts. Better order plenty before supply is exhausted again. Ship. wt. 13 lbs. Size 7¼" x 16½" x 7½". Brand New..... $2.50 ea.

New Torque Amplifier Only $9.75

FOR USE WITH SYNCHROS SIZE 3, 6, 7

Provides torque amplication and ease in rotation of input shaft. Rotating power applied to input shaft is reproduced in any direction on the output shaft. Torque supplied entirely by a 1/40 HP 110 V. AC motor through gear and planetary drive hookup. Speed varies directly with rotation of input shaft with noticeable loss of accuracy. Motor requires capacitor of 85-120 mfd. for starting. Designed for use on gun control devices and cost the Gvnmt. hundreds of dollars to mfg. In cast aluminum case. Size: 3 9/16" h. x 5⅛" w. x 7½" d. Wt. 23 lbs. Packed in original wood box. Shpg. wt. 45 lbs.
Brand New.....$9.95
Starting capacitor for above Torque Amplifier. New.....$1.00

SURPLUS ENGINE—New—$17.95

2.3 H.P. 2 cycle horizontal engine mfgd. by or for Jacobsen. Ball bearing crankshaft. Weight only 8½ lbs. Attach your own coil and battery for operation. Ideal for air propelled boat motor, ice sleds, models, etc. Complete as shown with timer, carburetor, and propeller (propeller hub shown not supplied). Ship. wt. 15 lbs.

TS-9 HANDSET—$2.95

Ideal for your mobile rig. Contains rec. element and single button carbon mike transmitter unit. Will replace your T-17 or other single button mike. Excellent in new condition. Ship. wt. 5 lbs. Price..$2.95 ea.

METAL LOCATORS—$29.50

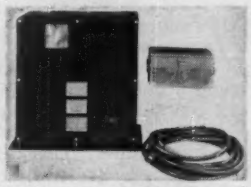
The famous SCR-625 mine detector which has been found to be unexcelled for locating hidden metallic objects such as pipes, treasure, etc. Hundreds in use by prospectors, mining companies, plumbers, veneer mills, etc. Comes complete in carrying case and checked ready for operation with addition of batteries, below. Case size 28¼" x 16" x 8¼". Operating carrying weight approx. 15 lbs. Ship. wt. 65 lbs.
Price.....$39.50 ea.
Batteries for above SCR-625.....Set, $4.25

Size & Type	Approx. Wt. Lbs.	Approx. length (in.)	Approx. Dia. in.	Price Used	Price New
6G Navy	8	6.4 - 7.5	4.5	$7.50	$25.00
7G Navy	18	8.9 - 9.2	5.8	10.00	30.00
7DG Navy	18	8.9 - 9.2	5.8	10.00	20.00

400 Cycle Units

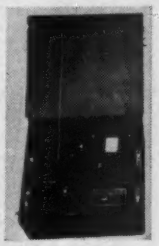
1J1G1 GE	1.5	4.3	2.3	none	3.50
5F Navy	5	6.0 - 6.8	3.4 - 3.6	3.50	none
5G Navy	5	6.0 - 6.8	3.4 - 3.6	3.50	none
5DG Navy	5	6.0 - 6.8	3.4 - 3.6	3.50	none

30 AMP. BATTERY CHARGER $12.50 ea.



Government cost $300 ea. Our purchase of large quantity allows this bargain. Ward-Leonard mfgd. type ED35150. Charging rates to 30 amps on 12-30 V. battery combinations. Operates from 110 V. DC. Size 20" wide x 20" high x 10" deep. Shipped in original overseas pack with metal box of spares and cord. Ship. wt. 145 lbs.
Price.....$12.50 ea.

TU-25-A TUNING UNIT—New—$1.95

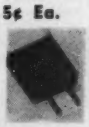


Transmitter type in range of 3500-5250 Kc. originally used on BC-223 transmitter but makes ideal foundation for your home constructed transmitter. Shipped in heavy 3/32" steel case with piano hinge cover. Case alone worth price. Complete, new.....$1.95 ea.

SPORTS HEATER—$4.95

A must for the duck hunter, sportsman, or field day ham. Burns kerosene or gasoline with an approx. output of 50,000 BTU of coarse-controllable for any variation below this max. Brand new, mfgd. by Evans for the Government for many times this price. Only 10" dia. and 12" high. Hang by bail or set on floor. In original Gvnmt. pack. Ship. wt. 47 lbs.....$4.95 ea.

Freq. Crystals—Less Than 5¢ Ea.



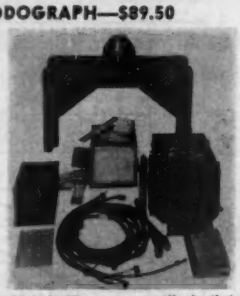
Imagine crystals costing Govnmt. $5.50 to $12.00 ea. in this assortment. 100 brand new; various freqs.; plenty in ham bands. Practically all types of holders; all mounted; guaranteed to oscillate. Assortment of 100.
Ship. wt. 4 lbs.....$4.95

STEAL THEM!

Brand New—Surplus Oil Capacitors

2 x 1 mfd. 600 V. Aerovox 24C16.....$2.50/doz.
4 mfd. 600 V. Sprague 23C16.....3.50/doz.
3 x .2 mfd. 4000 V. Tobe 30C10.....7.50/doz.
.12 mfd. 15000 V. G.E. Pyranol 33C10....2.50 ea.

M-1 ODOGRAPH—$89.50

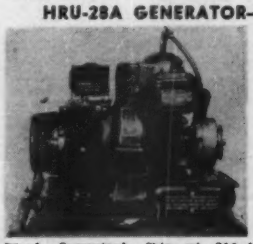


An instrument used for vehicular mapping of terrain over which it is driven. Compass information is passed on thru a photo electric circuit to the plotting unit which combines this information with the speedometer drive for control of the pencil across the map paper, giving a map with possible errors of less than 1%. Will do survey work in hours that normally require weeks. These instruments are new and the current mfgd. price is over $5,000. They are versatile in that parts can be adapted to other uses such as the compass unit to auto pilot boat control, etc. Ship. wt. 200 lbs.
U.S. Corps of Engineers rebuilt units. $89.50 complete
Brand new units.....$179.50 complete

R-1/ARR-1 RECEIVER—$1.95

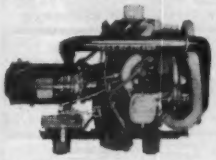
Described in Radio TV News, Jan. 1949, for use in 220 Mc. converter. Essentially a two stage RF acorn tube superhet converter as it now stands. Also can be used for a preselector. Small enough for mobile only 3½" w. x 3" h. x 10" d. Rugged aluminum construction. Has four 954 acorn tubes. Filaments now operate on 12 or 24 volts by merely throwing switch in unit or can be easily modified for 6 V. operation. Dial is calibrated in range of 234-258 MC. Operation can be changed for use from 50 to possibly 300 Mc. Brand New units demilitarized (input coil ceramic broken, easily repaired or used units not broken at same price). Ship. wt. 4 lbs.....$1.95
Co-Axial relay for use with above or other transmitter-receiver combination. Ship. wt. 2 lbs. New....$1.25

HRU-28A GENERATOR—$79.50



Homelite gasoline generator 28.5 V. DC at 2 KW. 3400 RPM motor speed. Electric or rope start. Use to power surplus aircraft radio equipment, cabin or marine power, aircraft starting, etc. These units rebuilt like new by the U.S. Air Force and have not been run since. Size 21½" x 24⅝" x 17½". Wt. 115 lbs. Original AF packed. Guaranteed. Ship. wt. 210 lbs. "Instruction book included."

ANDOVER POWER PLANTS—$185 ea.



This is the D2 plant that has been always in such great demand for use as portable welders and auxiliary power. Delivers 28.5 V. DC up to 200 amps. continuous. The lightweight aircraft type motor on these plants had a Gvnmt. acquisition cost of $2,937 each. Motor is 2 cylinder 4 cycle aircooled with hi-tension magneto type shielded ignition rated at 10 HP at 3200 RPM. Entire unit weighs approx. 125 lbs. Guaranteed good condition. Ship. wt. 300 lbs. Price.....$185
Engines only from above plant for only $125 ea. Ship. wt. 250 lbs.

SEXTANT $254 Value—$17.95

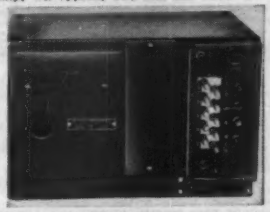
Air Force Bubble type sextant at a price to move quickly a large quantity surplus purchase. These instruments come in original carrying case complete with telescope but less battery case used for artificial light source (this can be made from a 2-cell flashlight). Mfg. by Ansco or Fairchild. Optics alone worth this price if you have no need for a sextant. Ship. wt. approx. 10 lbs.

STORAGE BATTERY PACK—BB-208 $3.50 ea.

Contains three 36 V. 18 cell lead acid batteries size 4¼" x 1-7/16" x 15/16". Wt. approx. 5 oz. ea., and one 6 V. 3 cell lead acid battery size 4-63/16" x 1¼" x 15/16". Wt. 5 oz. All batteries dry charged and must be filled in 1.265 sp.g. sulphuric acid before use. (Acid not incl.) Ideal for models, vest pocket transmitters and other compact service requirements. All new in vacuum sealed can. Ship. wt. of all 4 batteries 2 lbs.

Leeds & Northrup Micromax Recorders

Striptype recorder used for controlling and recording wide variety of processes. Used originally for temp. range of 350-550° C, but may be changed for other applications. Operates on Wheatstone bridge principle using AC galvanometer movement. Original cost several times our low price. Removed from demilitarized equipment which in many cases was new. Sold as used but guaranteed, or money back if not satisfied. Ship. wt. approx. 165 lbs. Ea. $179.50



BC-604 TRANSMITTER—$9.95 ea.

30 watt crystal controlled on 10 preselected channels in range of 20-27.9 Mc. F3 emission. Operates from 12 or 24 V. DC (dynamotor not supplied). Tubes and meter supplied worth price of entire unit. Size 12" x 10" x 12". Excellent to new condition. Ship. wt. approx. 100 lbs. ea. Price separately.....$9.95 ea.

115 V. 400 Cycle Inverter—New—$9.50

Just what is needed for operation of the numerous aircraft, radar, and electronic items on the surplus market requiring a 400 cycle 115V source at 100 watts or less. Input is 24 volts at 11 amps. Size 9"x6"x4½". Wt. 10½ lbs. Ship. wt. 12 lbs.

ESSE RADIO CO. • 42 WEST SOUTH ST. • INDIANAPOLIS 25, IND.

REMIT SHIPPING CHARGE AND INSTRUCTIONS WITH ALL ORDERS. OTHERWISE ORDER WILL BE SHIPPED EXPRESS COLLECT. ALL ITEMS GUARANTEED TO YOUR SATISFACTION OR MONEY REFUNDED IF RETURNED PREPAID WITHIN 10 DAYS OF RECEIPT.

It's packed with career facts! SEND FOR THIS FREE

STAN-BURN

CATHODE RAY TUBE SPECIALS

ONE YEAR GUARANTEE

O.E.	Type	STAN BURN	O.E.	Type	STAN BURN
$15.80	10BP4	$10.00	$34.75	17LP4	$18.00
19.10	12LP4A	13.95	37.00	19AP4A	24.00
.....	12QP4	11.50	38.35	20CP4A	18.95
30.25	12UP4	15.00	33.60	20CP4B*	21.95
30.75	14CP4	13.75	36.00	21AP4	25.00
.....	15DP4	14.50	30.75	21EP4A	20.15
33.75	16AP4	18.90	34.85	21EP4B*	23.25
32.20	16DP4A	15.25	30.90	21FP4	21.15
33.75	16GP4	18.75	37.00	21MP4	26.25
23.50	16KP4	15.75	28.75	21YP4	22.00
38.40	16KP4A*	18.75	34.85	21YP4A*	25.00
31.50	16LP4A	16.25	28.30	21ZP4	21.00
31.50	16WP4	16.25	33.60	21ZP4B*	24.00
23.50	17BP4	15.75	100.00	24AP4	66.00
28.40	17BP4B*	19.75		(6 mos. guar.)	
30.75	17CP4	20.50	48.40	24CP4A*	38.00
33.90	17GP4	21.50	50.00	24DP4A*	39.00

*ALUMINIZED—INQUIRE FOR ANY TUBE TYPE NOT LISTED. STAN-BURN CRT TUBES RCA LICENSED—MFD. BY LINCOLN. All orders of 6 or more STAN-BURN CRT are subject to additional 10% discount. PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

WHY PAY MORE? HI-FI COMPONENTS • KITS • RECORD PLAYERS • TAPE RECORDERS • TUNERS • AMPLIFIERS • SPEAKERS • ELECTRONIC PARTS & TUBES • Etc.

Top brand nationally adv. merchandise in this and other Radio & TV mags. is yours at low, low cost. Send us your list. Give Mfr's name and Model No. of item. Write for '57 catalogs to Dept. RTV-12 today.

BRAND NEW IMPORTED TAPE RECORDERS

Clear, sharp music and speech reproduction. Dual track, 5 tube balanced amp., 6" tape reel, Magic Eye tube, numerical footage counter, 2 tone maroon & grey leatherette case, portable, compact mechanism, weighs under 17 lbs. AMAZING VALUE!

SINGLE SPEED (3¾) $64.95
DUAL SPEED (3¾ and 7½) 74.95
FREE REEL OF TAPE WITH EACH RECORDER!

HI-FI DIAMOND NEEDLES—1 Yr. Guar.

Diamond needles reduce record wear and needle noise thus retaining full frequency response and tonal qualities of your records for a longer period of time.

SINGLE DIAMOND needle $7.95
DIAMOND SAPP dual needle 8.95
Shipment PPD. (specify cartridge make)

RECORD CHANGERS

COLLARO RC-456 4 speed changer $33.81
GARRARD RC-88 4 speed changer 53.41
GARRARD RC-98 4 speed changer 66.15
FREE wood mounting base, record wiping cloth and 45 RPM spindle with all orders for Collaro and Garrard changers, with this ad.

VM 4 SPEED HI-FI CHANGER—Model 1210 with Ronette or Astatic flip-over cartridge ... $22.95

MONARCH Model UA6U 4 SPEED AUTO. INTERMIX CHANGER less crystal cartridge $19.95

RONETTE (phono fluid) cartridge flip-over type $2.98
SONOTONE cartridge, flip-over $2.98
45 RPM SPINDLE for V.M. or Monarch ... $1.98
WOOD MOUNTING BASE for V.M. or Monarch $3.95
MOUNTING BOARD unfinished for V.M. or Monarch $1.50

NEW GENERAL ELECTRIC HI-FI VARIABLE RELUCTANCE CARTRIDGE. Replaces discontinued RPX050 type. Full range reproduction 20-20,000 cycles. Four gram tracking force for minimum record and stylus wear.

4G050—Dual Sapphire needles $8.77
4G052—Diamond, Sapphire needles $18.99

KITS! We stock the following manufacturers complete line of kits—see Advertisers Index for reference pages.

EICO — QUALITY — CABINART
DYNA — ROGEN — ELECTRO-VOICE
ARKAY — GROMMES — TECHMASTER

All domestic orders will be shipped prepaid. Send us your list. Order by Mfr. and Model No. of item.

$20 WORTH OF ELECTRONIC PARTS IN GRAB-BAG consisting of: Porcelain sockets, coils, speaker, trans resis. cond. ONLY ..... $1.98 (plus 50¢ postage)

1957 PHONOLA PHONOGRAPHS

All models have 4 speed automatic changers in portable carrying cases, shuts off after last record, jam proof, turnover cartridge, sapp needles, attractive modern styling with tone and volume controls:

No. 757 ECONOMY MODEL—mist blue and grey white simulated leatherette, crystal cart ... $37.50
No. 857—DUO-FI—2 speakers, 2 tone grey leatherette, 45 RPM spindle, ceramic cart. 49.00
No. 957 HI-FI—2 special HI-FI speakers, ebony starlite leatherette, 45 RPM spindle, ceramic cart 56.50
No. 1057 HI-FI—3 special HI-FI speakers, 3 controls (bass, treble & Vol.), ceramic cart., Diamond/Sapp needles, 45 RPM spindle, Luggage Tan leatherette 78.00

NATIONALLY ADVERTISED IN LIFE, POST, ESQUIRE

YOU NAME IT—WE HAVE IT

Complete line of T.V. & Radio receiving tubes, coils, transf., controls, antennas & accessories—No Minimum Order—DEALER DISCOUNTS! Thousands of satisfied Hi-Fi enthusiasts and dealers will vouch that STAN-BURN GIVES THE BEST DEAL POSSIBLE!

EXPORT INQUIRIES AND OFFERS INVITED
Terms: 20% with order. Balance C.O.D. All prices F.O.B. NEW YORK Warehouse.
Write for our latest price list and Hi-Fi Catalog RTV-12. All Prices Subject to Change Without Notice.

STAN-BURN RADIO and ELECTRONICS CO.
558 CONEY ISLAND AVE. • B'KLYN 18, N. Y.

Preamplifier Kit

(*Continued from page 65*)

are two conventional type printed circuit assemblies used—one for the tube circuitry and the other for the various components used in the equalizer circuit.

One of the greatest advantages in using this type of assembly is that it simplifies over-all construction and eliminates possible chances of error. It obviously makes for a more uniform performance.

The preamplifier itself incorporates all of the necessary controls that are found in most preamplifier designs. It has eight inputs—tape head, ceramic, *G-E, Pickering,* microphone, auxiliary, tape, and tuner. There are bass and treble tone controls, rumble filter, and separate loudness and level controls.

The equalizer circuit consists of two separate switches, one providing equalization for low-frequencies and the other for the high-frequencies. It is possible with these two controls to obtain 16 different combinations for record equalization.

The circuit itself is not too unusual. A low noise non-microphonic 12AY7 is used for the input-equalizer stage. Two ECC82/12AU7's make up the final two stages. A selenium rectifier is used in lieu of a tube rectifier. All heaters are d.c. operated and the preamplifier output is from a 500-ohm cathode follower.

Of greater importance to the user of this type of equipment is the over-all performance obtained. In view of this your editors had one of the production units assembled and tested. The results of the tests made are compiled in the chart shown below.

It is almost an impossibility today for the consumer to compare specifications from different manufacturers to judge the performance of a unit. Since no standards have been set on testing procedures, each manufacturer obviously uses his own judgement in specifying performance. In view of this, we are listing below the exact methods under which this unit was tested in the hope that some standardization can be obtained for future reporting.

Obviously it is not as complete as it should be but more time will give us a clearer picture of the problem and we'll keep all of our readers abreast as we proceed.

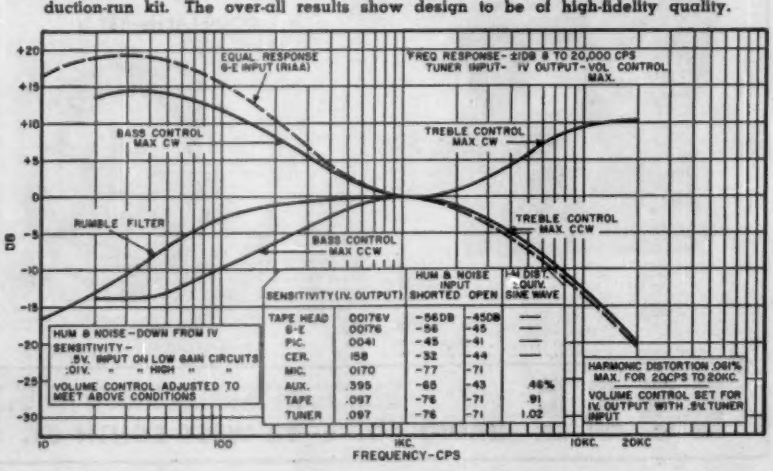
The frequency response, and bass, treble, and rumble performance were taken in the conventional manner with one volt input applied and volume control in maximum position. The tone controls were first adjusted for electrical center. The electrical centering of these controls does not conform exactly to the mechanical position as indicated by the "flat" position marks on the knobs. In this particular unit it was found that perfect centering was obtained when both the bass and treble tone controls were rotated approximately 13 degrees clockwise. Merely rotating the entire control 13 degrees off center corrected this condition. The rumble filter performance rolls off gradually, being 3 db down at 100 cycles and approximately 17 db down at 10 cycles. It is an effective rumble filter; however, when used it does attenuate the mid low-frequency response of the preamplifier.

The hum and noise characteristics were taken with tone controls electrically centered and volume control adjusted to produce one volt output for .5 volt input for all low gain circuits and .01 volt input for all high gain circuits.

The IM distortion measurements were taken with 60 and 6000 cycles (four to one ratio) and with an equivalent sine wave output of 1 volt and an equivalent sine wave voltage of .5 volt input. Tuner input only was measured for this test.

The results obtained certainly qualify this preamplifier as providing high-fidelity performance. Considering its initial cost, and it certainly is economical in price, it would be a good addition to any high-fidelity system. —30—

Performance characteristics of preamplifier kit. All tests were made in an independent laboratory and indicate actual performance obtained from a regular production-run kit. The over-all results show design to be of high-fidelity quality.



It's packed with career facts!

SEND FOR THIS

FREE

BOOKLET TODAY

your future in the new world of ELECTRONICS
RADAR • GUIDED MISSILES • SERVO •
COMPUTERS • AERONAUTICAL •
BROADCASTING AM FM TV •
MILITARY • NAVY • CAA •
COMMUNICATIONS •
MANUFACTURING
CAPITOL RADIO ENGINEERING

Turn this page

MAIL THIS POSTAGE-FREE POSTCARD TODAY

See what the rapidly expanding field of ELECTRONICS offers you

CAPITOL RADIO ENGINEERING INSTITUTE

ECPD Accredited Technical Institute Curricula. Founded 1927

[redacted] 3224 16th St., N.W., Washington 10, D. C.

(R. N. Dec. 57)

Please send me your course outline and **FREE** Illustrated Booklet **"Your Future in the New World of Electronics"** . . . describing opportunities and CREI home study courses in Electronic Engineering Technology.

RA1

CHECK FIELD OF GREATEST INTEREST

- ☐ Electronic Engineering Technology
- ☐ Broadcast (AM, FM, TV) Engineering Technology
- ☐ Television Engineering Technology
- ☐ Aeronautical Electronic Engineering Technology

Name ..... Age .....

Street .....

City ..... Zone ..... State .....

Check: ☐ Home Study ☐ Residence School ☐ Korean Veteran

To help us answer your request intelligently, please give the following information:

EMPLOYED BY .....

TYPE OF PRESENT WORK .....

SCHOOL BACKGROUND .....

ELECTRONICS EXPERIENCE .....

IN WHAT BRANCH OF ELECTRONICS ARE YOU MOST INTERESTED? .....

RIDER BOOKS ARE THE EASY, LOW-COST WAY

CREI prepares you quickly for success in

- RADAR
- GUIDED MISSILES
- SERVO-MECHANISMS
- COMPUTERS
- AERONAUTICAL ELECTRONICS
- BROADCASTING, AM, FM, TV
- MILITARY, NAVY, CAA ELECTRONICS
- COMMUNICATIONS
- ELECTRONICS MANUFACTURING

The future is in your hands!

The signs are plain as to the future of the trained men in the electronics industry. It is a tremendous industry, and—at the *present time* there are more jobs than there are trained men to fill them. But—when there's a choice between a trained and untrained applicant, the trained man will get the job. Your biggest problem is to decide on—and begin the best possible training program.

CREI Home Study . . . The Quick Way to Get There.

Since 1927, CREI has given thousands of ambitious young men the technical knowledge that leads to more money and security. The time-tested CREI procedure can help *you*, too—if you really want to be helped. CREI lessons are prepared by experts in easy-to-understand form. There is a course of instruction geared to the field in which you want to specialize. You study at *your* convenience, at *your* rate of speed. Your CREI instructors guide you carefully through the material, and grade your written work personally (not by machine).

Industry Recognizes CREI Training.

CREI courses are prepared, and taught with an eye to the needs and demands of industry, so your CREI diploma can open many doors for you. Countless CREI graduates now enjoy important, good-paying positions with America's most important companies. Many famous organizations have arranged CREI group training for their radio-electronics-television personnel. To name a few: All American Cables and Radio, Inc.; Canadian Broadcasting Corporation; Columbia Broadcasting System; Gates Radio Company; Hoffman Radio Corporation; Federal Electric Corporation; Glenn L. Martin Company; Douglas Aircraft Co.; Pan American Airways, Atlantic Division; U.S. Information Agency (Voice of America); Canadair Limited; Trans-Canada Air Lines; United Air Lines. Their choice for training of their own personnel is a good cue for *your* choice of a school.

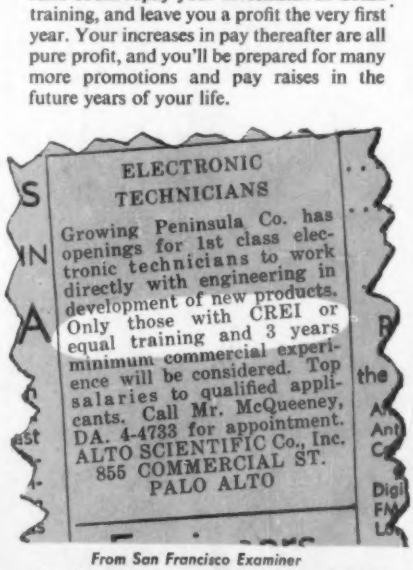
Benefits Felt Right Away.

Almost immediately you feel the benefits of CREI training. Your employer, when informed of your step toward advancement (only at your request), is certain to take new interest in you and in your future. What you learn in CREI Home Study can start helping you do a better job immediately.

CREI also offers Resident Instruction

at the same high technical level—day or night, in Washington, D. C. New classes start once a month. If this instruction meets your requirements, check the coupon for Residence School catalog.

PAYS FOR ITSELF QUICKLY. Your very first raise could repay your investment in CREI training, and leave you a profit the very first year. Your increases in pay thereafter are all pure profit, and you'll be prepared for many more promotions and pay raises in the future years of your life.



ELECTRONIC TECHNICIANS

Growing Peninsula Co. has openings for 1st class electronic technicians to work directly with engineering in development of new products. Only those with CREI or equal training and 3 years minimum commercial experience will be considered. Top salaries to qualified applicants. Call Mr. McQueeney, DA. 4-4733 for appointment.
ALTO SCIENTIFIC Co., Inc.
855 COMMERCIAL ST.
PALO ALTO

From San Francisco Examiner

Industry Calls for CREI Training by Name . . . So Should You!

Here you see an actual help-wanted ad, one of many which specify "CREI or equal" training. This proves that industry approves CREI training, even insists on it!

Send card today for this fact-packed booklet. It's free.

Take 2 minutes to send for this booklet right now. We'll promptly send your copy. The rest—your future—is up to you.

1st Class
Permit No. 288-R
Sec. 34.9 P.L.R.
Washington, D. C.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in United States

3c Postage Will Be Paid By

CAPITOL RADIO ENGINEERING INSTITUTE

3224 16th Street, N.W.

Washington 10, D. C.

Antenna News

REAR-DECK AUTO ANTENNA

Snyder Mfg. Co. of Philadelphia, Pa., is now offering a completely new, streamlined rear-deck auto antenna designed to fit the modern high-finned cars.

Designed to be mounted anywhere on an auto, the "Shark" is said to provide peak reception throughout the country and in fringe radio reception areas. The unit can be installed on the front fender (Model TC-17) or on the trunk lid (Model TC-17T) as well as used as single rear deck or dual rear deck antennas (RD models).

The "Shark" is a three-section antenna which extends from 13½" to 27". It comes complete with high-"Q" coaxial cable harness and two plastic base insulators to fit all fender contours.

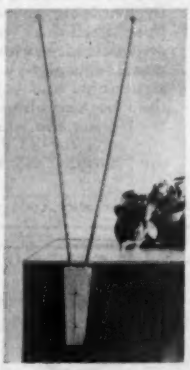
PARABOLIC REFLECTORS

Andrew Corporation, 363 East 75th St., Chicago 19, Ill. has developed a heavy-gauge spun-aluminum parabolic reflector which has been designed especially for experimental and special microwave work. Horizontal and vertical mounting attachments are available to provide maximum flexibility.

Units available in this new line range from 20 to 120 inches in diameter, focal lengths from 5 to 35.8 inches. A data sheet, Bulletin No. 8438, is available on request.

"TUK-IT HIDEAWAY"

Snyder Mfg. Co. of Philadelphia is now in production on its "Tuk-It Hideaway" indoor antenna which has been designed for easy mounting on the back of a table model, console, or portable television receiver.



Housed in an ivory molded plastic case, the Model PT-R can be attached directly and quickly to any TV set in a matter of minutes. A cable attaches to the antenna outlet adjacent to the mounting of the antenna. The antenna can be used for black-and-white, color, FM, v.h.f. or u.h.f. reception.

ANTENNA ACCESSORIES

Channel Master Corp. of Ellenville, N. Y. has added a number of new items to its line of antenna accessories.

Fifteen new mounts, featuring both tubular and flat steel construction, are now being offered. The mounts are zinc electroplated for permanent protection

RIDER BOOKS ARE THE EASY, LOW-COST WAY TO GREATER ELECTRONIC KNOW-HOW!

FIVE NEW RIDER BOOKS

☐ **STEREOPHONIC SOUND**
by Norman H. Crowhurst
World-famous audio authority Norman H. Crowhurst's new book is the first true assessment of this exciting new medium for realistic sound. It covers the theory of stereophonic sound, the differences it can make in reproduction, what goes into making it successful, and what is needed to bring out the best in systems available or likely to be available. The book applies all this information to selecting the proper loudspeakers and components for the best stereo reproduction. It also covers stereo systems and techniques used for motion pictures. Soft cover, 128 pp., 5½x8½", illus. #209.....$2.25

☐ **HOW TO READ SCHEMATIC DIAGRAMS**
by David Mark
Covering the symbols and abbreviations used in schematic diagrams related to the electronics field, this book starts with individual components and carries through to receivers and similar equipment. Components and circuits are identified and explained.
Soft cover, approx. 160 pp., 5½ x 8½", illus.
#208 .....$3.50

☐ **REPAIRING HI-FI SYSTEMS**
by David Fidelman
This book deals with finding the troubles and repairing faults in hi-fi equipment with no test instruments—simple equipment—and elaborate equipment.
Typical troubles are analyzed and repaired through a system of logical steps. This book is broad in scope, yet maintains a simplified level. Soft cover, approx. 170 pp., 5½x8½", illus. #205 .....$3.96

☐ **HIGH FIDELITY SIMPLIFIED (3rd Edition)**
by Harold D. Weiler
Gives you the complete up-to-the-minute hi-fi story, and answers all questions about tuners, changers, amplifiers, tape recorders, speakers, record players, etc. No other book like it! Soft cover, 210 pp., 5½x8½", illus. #142 .....$2.50

Coming in December . . .
BASICS OF DIGITAL COMPUTERS by John S. Murphy
For a career in the fastest-growing segment of the electronics industry read this 3-volume "Picture-Book" course.

Famous RIDER "Picture-Book" Courses...

☐ **BASIC TELEVISION** by Dr. Alex. Schure
The whole world of black and white television is before you for only $10.00.
You can master the basics of television easily, rapidly and thoroughly with this 5-volume "learn by pictures" training course.

It's so easy to learn
Here's how this easy, illustrated course works. Every page covers one complete idea! There's at least one big illustration on that same page to explain it! You build a thorough, step-by-step knowledge at your own pace—as fast as you yourself want to go.

No experience, education needed
BASIC TELEVISION uses the same methods that have proven so successful in the famous Rider picture books on electricity and electronics. All that is assumed is that you have a knowledge of radio. Every phase of television is made instantly clear—explained in plain English supported by carefully prepared, large and exciting drawings that make every idea crystal clear.
#198, soft cover 5 volumes, $10.00 per set; #198-H, cloth bound in a single binding, $11.50

☐ **BASIC ELECTRICITY**
☐ **BASIC ELECTRONICS**
☐ **BASIC SYNCHROS & SERVOMECHANISMS**
by Van Valkenburgh, Nooger Neville, Inc.
The fabulous picture-text books that teach faster and easier! The theory, principles, and practice of electricity, electronics, and synchros and servos are here presented in a manner that permits a rapid grasp of the fundamentals of these vitally important subjects. Over 2,000 specially prepared illustrations present, explain, and make every topic discussed picture-clear.

Basic Electricity
#169, soft cover, 5 vols., 624 pp., per set $10.00
#169H, cloth bound in single binding....$11.50

Basic Electronics
#170, soft cover, 5 vols., 530 pp., per set $10.00
#170H, cloth bound in single binding....$11.50

Basic Synchros and Servomechanisms
#180, soft cover, 2 vols., 270 pp., per set $5.50
#180H, cloth bound in single binding... $6.95

INCREASE YOUR KNOW-HOW WITH THESE RIDER BOOKS...

☐ **TV Picture Tube-Chassis Guide**
by Rider Lab Staff
#204, soft cover, 68 pp. $1.35
☐ **Marine Radiotelephone Permit Q & A Manual (3rd class operator)**
by Milton Kaufman
#206, soft cover $1.35
☐ **Energy**
by Sir Oliver Lodge, F.R.S.
#200, soft cover, 64 pp. $1.25
☐ **Getting Started in Amateur Radio**
by Julius Berens W2PIK
#199, soft cover, 136 pp. $2.40
☐ **Hi-Fi Loudspeakers & Enclosures**
by Abraham D. Cohen
#176, MARCO cover, 360 pp. $4.60
#176H, cloth bound $5.50
☐ **How to Service Tape Recorders**
by C. A. Tuthill
#167, soft cover, 160 pp. $2.90
☐ **Basic Vacuum Tubes & Their Uses**
by Rider & Jacobowitz
#171, soft cover, 208 pp. $3.00
#171H, cloth bound $4.50
☐ **How to Use Meters**
by John F. Rider
#144, soft cover, 144 pp. $2.40
☐ **Fundamentals of Transistors**
by Leonard Krugman
#160, soft cover, 144 pp. $2.70
☐ **Introduction to Color TV (2nd Edition)**
by Kaufman & Thomas
#156, soft cover, 160 pp. $2.70
☐ **How to Select and Use Your Tape Recorder**
by David Mark
#179, soft cover, 148 pp. $2.95
☐ **Television — How It Works (2nd Edition)**
by J. Richard Johnson
#101, leather finish MARCO, 352 pp. $4.60
#101H, cloth bound $5.50
☐ **Repairing Television Receivers**
by Cyrus Glickstein
#191, soft cover, 212 pp. $4.40
☐ **Transistor Engineering Reference Handbook**
by H. E. Marrows
#193, cloth bound, 9x12", 288 pp. $9.95

☐ **HOW TO INSTALL & SERVICE INTERCOMMUNICATION SYSTEMS** by Jack Darr
#189, soft cover, 152 pp. $3.00
☐ **SERVICING TV AFC SYSTEMS** by John Russell, Jr.
#192, soft cover, 128 pp. $2.70
☐ **SERVICING TV VERTICAL & HORIZONTAL OUTPUT SYSTEMS** by Harry Thomas
#150, soft cover, 176 pp. $2.40

ELECTRONICS TECHNOLOGY SERIES
edited by Alex. Schure, Ph.D., Ed.D.
☐#166, RC & RL Time Constant, $.90 ☐#166-2, FM Limiters & Detectors, $.90 ☐#166-3, Frequency Modulation, $.90 ☐#166-4, Crystal Oscillators, $1.25 ☐#166-5, A-M Detectors, $1.25 ☐#166-6, Limiters & Clippers, $1.25 ☐#166-7, Multivibrators, $.90 ☐#166-8, R-F Transmission Lines, $1.25 ☐#166-9, Amplitude Modulation, $1.25 ☐#166-10, Blocking Oscillators, $1.25 ☐#166-11, Wave Propagation, $1.25 ☐#166-12, Superheterodyne Converters & I-F Amplifiers, $.90 ☐#166-13, L-C Oscillators, $1.25 ☐#166-14, Antennas, $1.50 ☐#166-15, Inverse Feedback, $.90 ☐#166-16, Resonant Circuits, $1.25 ☐#166-18, D-C Circuit Analysis, $1.35

FREE! Handsome genuine leather, gold-stamped bookmark, if you write today for FREE 1957 Catalog RN-12.

Buy these and many other RIDER BOOKS at your electronics parts jobber, book store or department store book department. Look for the Rider Bookseller.

If your favorite store does not sell the Rider books you want, order direct. Add state, city tax where applicable. Canadian prices 5% higher.

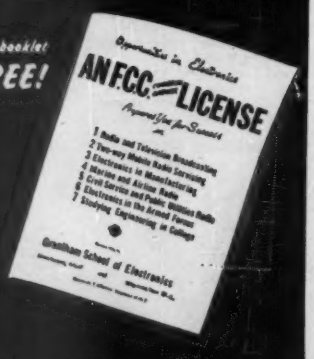
JOHN F. RIDER PUBLISHER, Inc. 116 West 14th Street, New York 11, N.Y.
In Canada: Charles W. Pointon, Ltd. 6 Alcina Ave., Toronto, Ontario

GET YOUR First Class Commercial F. C. C. LICENSE IN 12 WEEKS!

Learn by Mail or in Resident Classes

Grantham Schools specialize in preparing students to pass F. C. C. examinations. Correspondence courses are offered from Hollywood, Calif., and Washington, D. C.; also, resident DAY and EVENING classes are held in both cities. Either way, you are trained quickly and well—NO previous training required. A beginner may qualify for his first class F. C. C. license in as little as 12 weeks. Get details in our FREE booklet.

This booklet FREE!



For FREE Booklet CLIP COUPON and mail in envelope or paste on postal card

MAIL TO SCHOOL NEAREST YOU

Grantham Schools, Desk 76-T

821 - 19th Street N.W. Washington 6, D.C. OR 1505 N. Western Ave. Hollywood 27, Calif.

Please send me your free booklet telling how I can get my commercial F.C.C. license quickly. I understand there is no obligation and no salesman will call.

Name _____ Age _____

Address _____

City _____ State _____

I am interested in: ☐ Home Study, ☐ Resident Classes

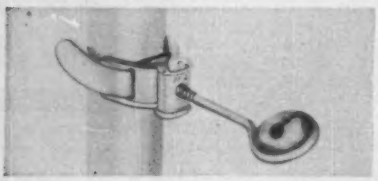
against corrosion. In addition, the mounts are constructed to absorb antenna stress far in excess of normal demands.

Among the items added to the line are a universal swivel base mount for flat or peak roof installations, a ground mount with 18" long angle "spike," swivel roof mount, three adjustable eave mounts, two wall units, two adjustable wall mounts, a snap-in wall mount, and four tubular wall mounts ranging from 12" to 24".

A data sheet on this new line is available on request.

UNIVERSAL STAND-OFF

JFD Manufacturing Co., Inc., 6101 16th Ave., Brooklyn 4, N. Y. has developed a new universal strap stand-off that accommodates any No. 8 or No. 9 standard wood screweye.



The advantage of this new "Imp" design is that it eliminates the need to stock a wide variety of stand-offs as well as providing a 50% reduction in storage space over present types. The buckle utilizes a double-seated thread lock which exerts two separate tensions on the wood screw as it is tightened. This progressively increases the pressures of the outer thread and the inner thread locks, insuring a slip-proof, strip-proof installation.

A 4-page brochure describing these new units will be supplied without charge upon request.

SKIVED TAPE

Dixon Corporation of Bristol, Rhode Island is now offering a new line of "Teflon" skived tape for wire and cable wrapped insulation.

The new tape features a dielectric strength of 1000 to 2000 volts per mil of thickness and a dielectric constant of 2 through the entire frequency range. Power factor is less than .0003 over the whole frequency range. The tape has zero moisture absorption, is tough and flexible through a temperature range of −400 through +500 degrees F. Tensile strength is over 2000 psi.

The tape comes in widths of 3/16", 1/4", 3/8", 1/2", 5/8", 3/4" and in thicknesses from .002" up. -30-

CODE OSCILLATOR FOR PROSPECTIVE HAMS

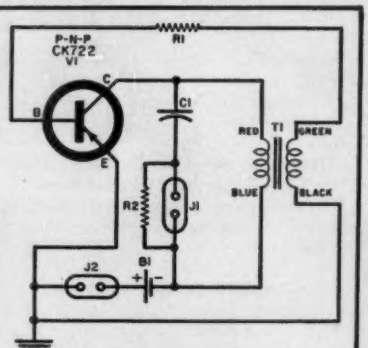
WOULD-BE HAMS and SWL's are always interested in finding new and easy-to-build code practice oscillator circuits. With the current availability of low-cost, general-purpose "p-n-p" transistors, it is now possible to build extremely compact, self-contained instruments which are independent of power lines.

A very simple circuit, using a single CK722 transistor and a 1½-volt penlite cell as the power source, has been designed by engineers at Allied Radio. The circuit will cover the frequency range from 400 to 600 cps. It may be housed in a compact case whose dimensions need not exceed 4" x 2⅞" x 1⅝". It has been estimated that the unit will oscillate continuously for about 30 weeks on the single cell. Since the circuit will probably never be called upon for this type of operation, battery life should approximate shelf life.

The only accessories needed with this code practice oscillator are a pair of 2000-ohm headphones and a key. The oscillator is designed with jacks to accommodate both of these items and to facilitate quick connection and disconnection.

The schematic diagram clearly indicates the simplicity of the circuit, which can be constructed from standard, readily available parts. Those who prefer a "packaged deal" which includes all parts, an enclosure with anodized aluminum panel, complete wiring and assembly instructions, and information on learning the code can obtain it from Allied which is offering the whole kit, less earphones and key, for $3.95. It is catalogued as the "Knight" 83 Y 239 kit. -30-

Schematic and over-all view of the "Knight" transistor code practice oscillator.



R_1—15,000 ohm, ½ w. res.
R_2—220,000 ohm, ½ w. res.
C_1—.01 μfd., 300 v. disc ceramic capacitor
J_1—Dual phone jack
J_2—Key terminals
B_1—1½ volt penlite cell (Burgess Type Z)
T_1—Transistor trans. (Allied No. 103201)
V_1—"p-n-p" transistor (Raytheon CK722)

Accessories
Headphones—2000-ohm dual phones (Allied 59J110 or equiv.)
Key—Practice key (Johnson Model 114-300 or equiv.)

Three Antennas, One Lead

(*Continued from page 49*)

tin the points of contact before doing the actual soldering at the points shown in Fig. 7.

In measuring the sections of transmission line to exact quarter wavelengths, the propagation factor of transmission line must be taken into account. For most flat 300-ohm line it is .82. That is, the length of quarter-wave along a transmission line will be .82 of the length in free space. Specific information for special types of line is available from the manufacturer or the dealer.

In actual practice, the author had an installation, shown in Fig. 1, using three yagis with separate lead-in wires. When he connected the three antennas through the matching network shown, an improvement in signal was noted on two of the three channels. Channel 8, which had been snowy before introduction of the network, was snow-free after the change was made.

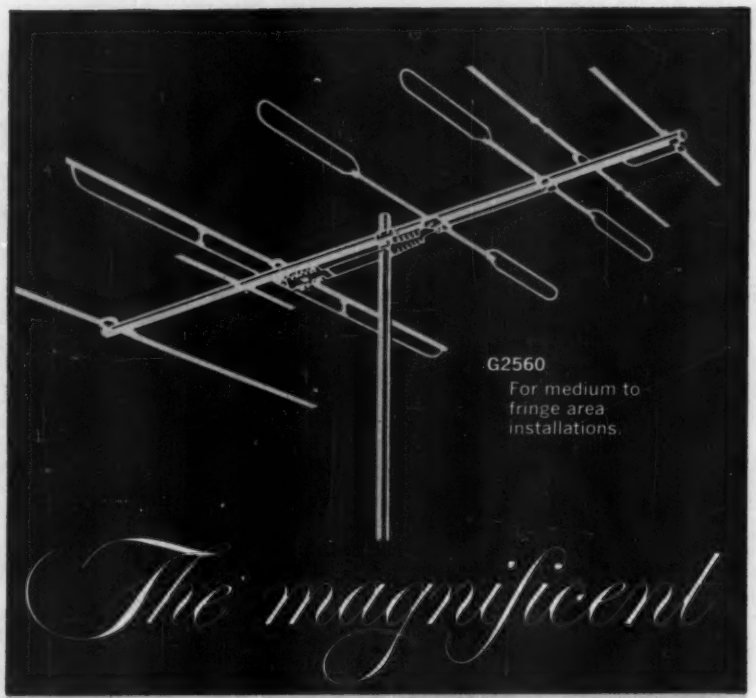
The switch is relatively simple to construct and the components are both inexpensive and easy to obtain. The switch can be folded and sealed in a plastic case to protect it from adverse weather conditions. In the author's installation (Fig. 2), the elements in the matching network were folded up into a cigar box, which was covered with water-proof tape. (See Editor's Note.)

One limitation on the switch is its use where the frequencies of two of the channels involved are harmonically related. In this case, a stub tuned in to one of them cannot be made to tune out the other. In general, however, it will be a useful link in multiple-antenna fringe installations that inhibits unnecessary loss of signal.

EDITOR'S NOTE: *The author's solution to his problem is far from being theoretically perfect. At least some of his success would seem due to coincidences involving specific frequencies, and not likely to hold true in all cases. Nevertheless, he has tackled a recurrent problem with boldness and imagination. His approach is potentially helpful to many, with alterations as the individual situation may require.*

Although each leaf in the system is an open circuit at its open end, impedance will vary at other points along the leaf. At the point where the leaf joins its leg, it could turn out to be a short circuit or a low impedance, depending on the frequencies involved. In fact, in many cases, better results may be obtained by omitting altogether the additional shorted section on the far end of each leaf.

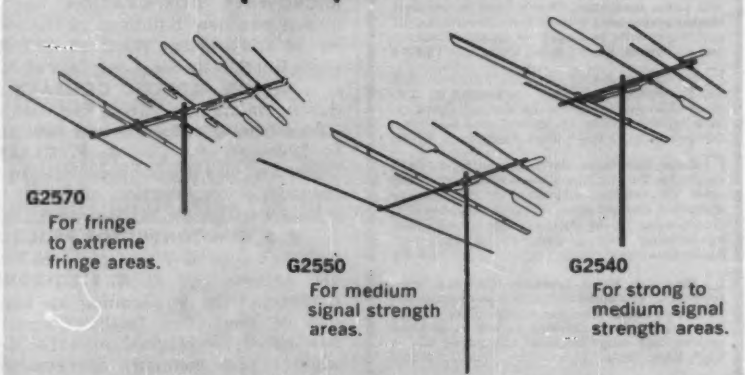
Also, physically folding the network to fit it into the confines of a cigar box introduces many hazards. Mutual-impedance effects and other interactions might completely destroy the usefulness of the matching system, at worst: here, too, the author has been fortunate. Interested readers would do well to check performance during experimental attempts at folding to avoid signal sacrifices. —30—



The magnificent

TACO GOLDEN Toplíner™

without equal for performance, quality and value



Write for complete technical details...

TACO Toplíners™

TECHNICAL APPLIANCE CORPORATION, SHERBURNE, N. Y.

In Canada: Hackbusch Electronics, Ltd., Toronto 4, Ont.

SAMS "BEST SELLER" BOOKS

FOR THE TECHNICIAN • STUDENT
EXPERIMENTER • HOBBYIST

USE THIS HANDY ORDER FORM

☐ **Pinpoint TV Troubles in 10 Minutes.** Amazingly practical procedures for solving TV troubles. Includes over 50 time-saving check charts, dozens of diagrams and test Methods, circuit explanations, etc.—a real timesaver for TV repairs. 299 pages; 5½ x 8½"; fully illustrated. Only.....**$3.95**

☐ **TV Servicing Guide.** Quick reference guide for Technicians. Trouble symptoms are illustrated by picture tube screen photos and proper repair procedures are clearly described. Covers all sections of the TV circuit. 132 pages; 8½ x 11"; illust. Only.....**$2.00**

☐ **Tape Recorders.** Explains recorder theory, tape characteristics, how recorders work; covers motorboard mechanisms, drive motors, volume indicators, bias oscillators, amplifiers, magnetic heads, equalization circuits. 176 pages; 5½ x 8½"; illust. Only.....**$2.75**

☐ **Transistor Circuit Handbook.** The authoritative book on transistor types, construction, characteristics, applications, circuitry, techniques for wiring and testing. Covers every phase of the subject. 430 pages; 6 x 9"; illust. Only **$4.95**

☐ **Hi-Fi Handbook.** Invaluable data on Hi-Fi design, selection and installation, including fidelity, sound theory, analysis of all components (speakers, enclosures, amplifiers, tuners, etc.), systems design, proper selection and installation. 240 pages; 5½ x 8½"; illust. Only .**$3.00**

☐ **Servicing AGC Systems.** Describes operation and circuit variations of AGC systems; explains applicable servicing techniques. Illustrated by actual case histories and photos of symptoms. 132 pages; 5½ x 8½"; illust. Only.....**$1.75**

☐ **Learning Electricity Fundamentals.** The complete, fascinating story of electricity: history, electron theory, static electricity, uses of switches and fuses, resistance, Ohm's Law, magnetism, electro-magnetism, transformers, generators and motors, circuits and controls, practical wiring, etc. 416 pages; 6 x 9"; illust. Only.....**$5.95**

☐ **Transistors.** A very practical, complete book on Transistors and their application in TV-Radio-Electronics. Explains theory, circuitry, installation, testing techniques and servicing. 100 pages; 5½ x 8½"; illust. Only.....**$1.50**

☐ **Color Television.** An outstanding training course for Technicians. Covers principles of the color TV system; color receiver circuits; installation and servicing of color receivers. Includes color blocks outlining use of color test equipment. 260 pages; 8½ x 11"; profusely illustrated. Only.. .**$6.95**

☐ **Electronic Metal Locators.** Explains basic types and their operation; tells how to construct your own units; describes applications. Covers interesting uses in industry as well as in prospecting and mine location. 124 pages; 5½ x 8½"; illust. Only.....**$2.50**

HOWARD W. SAMS & CO., INC.

Order from your Parts Jobber, or mail to Howard W. Sams & Co., Dept. 1-M7 2201 E. 46th St., Indianapolis 5, Ind.

Send books checked above. My (check) (money order) for $.....is enclosed.

Name_____

Address_____

City_____ Zone____ State_____

(outside U.S.A. priced slightly higher)

Within the Industry

(Continued from page 34)

plant at 546 Commerce Street, Thornwood, N. Y. The former location of the company was in Pleasantville, N. Y. . . . **WELLER ELECTRIC CO.** will centralize all production, sales, and administrative operation in the U. S. at its present general offices in Easton, Pa. New facilities are planned to quadruple the space of the present 12,000 square foot building. An additional 40,000 square feet will be added . . . A new wing that adds 100,000 square feet to the **WESTINGHOUSE ELECTRIC CORPORATION'S** air arm division, Baltimore, Md., has been completed. . . . In an expansion move, **THE CALIDYNE COMPANY** has begun construction of a new 46,000 square foot plant in Woburn, Mass. Upon completion it is expected to cost approximately half a million dollars . . . **TELE-DYNAMICS, INC.** has completed occupation of new plant facilities at 5000 Parkside Avenue, Philadelphia, Pa. . . . **METHODE MANUFACTURING CORPORATION** has moved a portion of its operations to 7447 Wilson Ave., Harwood Heights, Chicago, Ill., occupying a new, one-story plant especially designed for its manufacturing requirements . . . **LING ELECTRONICS, INC.** has completed plans for expansion into a second, new plant in Los Angeles. The new buildings, located in Culver City, Calif., will house administrative, engineering, and sales as well as additional manufacturing facilities . . . **ACOUSTICA ASSOCIATES, INC.** has moved to new and larger quarters at 26 Windsor Ave., Mineola, Long Island, N. Y. . . . **THE NARDA MICROWAVE CORPORATION** has acquired two new buildings in the vicinity of the present plant at 160 Herricks Road, Mineola, Long Island, N. Y. . . . **GIBSON ELECTRIC COMPANY** has moved its manufacturing facilities and offices from Pittsburgh to a new plant in Delmont, Pa. . . . **C. P. CLARE & COMPANY** has announced plans for the immediate construction of a new, ultra-modern plant at Fairview, N. C. . . . **U. S. SEMICONDUCTOR PRODUCTS, INC.** has opened a new plant in Phoenix, Arizona . . . **C. G. ELECTRONICS CORPORATION** is planning an expansion of production facilities equal to five times its original manufacturing spaee. This company operates as a wholly owned subsidiary of **GULTON INDUSTRIES, INC.** . . . Expansion of facilities has been announced by **FAIRCHILD CONTROLS CORPORATION'S** components division, subsidiary of **FAIRCHILD CAMERA AND INSTRUMENT CORPORATION.**

* * *

ELECTRONIC INDUSTRIES ASSOCIATION (formerly RETMA) has announced the results of its survey on industry trade shows.

The survey was conducted by the association's marketing data department under the direction of the trade show survey committee. This committee was established to study the effectiveness and utility of trade shows in the electronics industry.

Both the number of solicitations received by electronic manufacturers to exhibit their products and the cost of participation in trade shows showed a substantial increase in 1956 over 1955. For example, the companies classified as manufacturers of technical products showed an increase of 81% in these solicitations over the previous year. The average electronics manufacturer, however, did not increase his number of exhibitions last year in spite of receipt of nearly a 50% increase in requests.

The cost per show for the average electronics manufacturer increased by 14% in 1956 over 1955, according to the survey. Only parts, tube, and semiconductor manufacturers were below the industry average both years.

A significant fact gleaned from the survey showed that more electronic manufacturers favor two trade shows per year more than any other number. The replies indicated that only 13% of the industry favor more than four shows a year.

The association grouped the comments of respondents by types and expressed them as a per-cent of the total replies. Some of these comments were: "National shows becoming too large," 44%; "Increasing difficulty to effectively demonstrate products," 28%; "Cost of shows exceeding benefit received," 24%.

* * *

GEORGE I. LONG, JR., president of *Ampex Corporation,* has been named to the board of directors of *ORRadio Industries, Inc.*

A graduate of Stanford University, Mr. Long was with the Wells Fargo Bank of San Francisco for 20 years. In 1950 he resigned as assistant vice-president of this bank to become treasurer of the tape recording equipment concern. He successively became vice-president and general manager, executive vice-president, and in 1955 was elected president.

He is a director of the West Coast Electronic Manufacturers Association.

* * *

CONTACTS INCORPORATED has been organized in Wethersfield, Conn. President of the new firm is Robert W. Spellman and K. L. Emmert is vice-president and chief engineer . . . **BRAND PRODUCTS, INC.,** Westbury, N. Y., a new sales and marketing organization, has been formed by Mort Wimpie . . . A new firm, **AUERBACH ELECTRONICS CORPORATION,** has been formed with headquarters in Narberth, Pa. Heading the organization is Isaac L. Auerbach . . . **L. A. YOUNG SPRING & WIRE CORP.** has purchased the assets and manufacturing rights of the **LINK RADIO CORP.** . . . **NADER MANUFACTURING CO.** and

JUST PUBLISHED!

164 PAGES— OVER 1,000 LISTINGS WITH ILLUSTRATIONS OF ALL HI-FI PRODUCTS ON THE MARKET!

World's First Complete

HI-FI DIRECTORY & BUYERS' GUIDE!

Here's the one indispensable book in your hi-fi library . . . the first complete listing of all hi-fi equipment on the market, plus dollars-and-cents advice on how to pick the right unit for your needs! Call it a shopping catalog, a sourcebook of practical hi-fi ideas, an encyclopedia of hi-fi values, a treasury of practical material you'll use over and over again—the *1958 Hi-Fi Directory & Buyer's Guide* is the biggest bargain on your newsstand!

ALL HI-FI EQUIPMENT COVERED...INCLUDING PRICES, MANUFACTURERS AND SPECIFICATIONS!

Facts on preamps & amplifiers
Buying a record changer
Phonograph accessories
Wise shopping for a turntable
Complete facts on speakers
Illustrated guide to enclosures & cabinets
Special section on tape recorders
Guide to speaker systems
Records on a budget
Choosing AM and FM tuners
Selecting a hi-fi console

PLUS Records recommended by Eugene Ormandy . . . and a full list of hi-fi dealers in the U.S.A.—where to buy hi-fi in your community!

Pick up a copy of the 1958 Hi-Fi Directory & Buyers' Guide at your newsstand now while supplies last. Only $1.

A ZIFF-DAVIS PUBLICATION

Ziff-Davis Publishing Company
64 E. Lake St., Chicago 1, Ill.

NEW

KINGSTON'S

PROBE-MASTER

a more versatile probe,
combined with a neon tester and a
built-in CAPACITIVE NETWORK
which allows:

- by-passing stages
- checking open condensers
- coupling signals from one stage to another
- isolating a defective stage
- elimination of condenser substitution
- checking series string filaments

2 Clips for greater versatility

ASK YOUR FAVORITE DEALER...
or WRITE:

KINGSTON
ELECTRONIC CORPORATION
MEDFIELD, MASSACHUSETTS, U.S.A.

MOTORDYNE, INC. have merged. The corporate name of the resultant company will be **MOTORDYNE, INC.** . . . **BECKMAN INSTRUMENTS, INC.** has acquired the outstanding stock of **ARNOLD O. BECKMAN, INC.** . . . **TOWER CONTRACTING CO., TAYLOR MAINTENANCE CO.,** and **ATLAS MANUFACTURING CO.** have been consolidated into **NATIONAL ELECTRONIC FACILITIES, INC.,** Dallas, Texas.

* * *

ELECTRONIC PARTS DISTRIBUTORS SHOW has announced the appointment of committees for the 1958 show. Men noted for their prominence in various branches of the fast-growing electronic parts industry were chosen by Charles Golenpaul, *Aerovox Corporation,* who is president of the corporation, to serve on the seven committees.

The chairmen of these committees are:

Entertainment, A. N. (Bud) Haas, *Bud Radio Inc.;* Housing, Morris Green, *Almo Radio Supply Co.;* Publicity, Meyer J. Spiro, *Meyer's Electronics Inc.;* Education and Program, Sidney Harman, *Harman-Kardon, Inc.;* Credentials, Merle Applebee, *Burstein-Applebee;* Space and Arrangements, William J. Moreland, *Conrac Inc.;* and Finance, Roy S. Laird, *Ohmite Manufacturing Company.*

* * *

ROLLAND L. SHOEMAKER has been appointed manager, commercial service, *RCA Service Company, Inc.* . . . *Erie Resistor Corp.* has named **DR. JAMES G. BUCK** director of research and development . . . **DALE V. CROPSEY** has been elected vice-president in charge of industrial divisions for *Elgin National Watch Co.* His responsibilities include supervision of both the electronics and abrasives divisions of the firm . . . **WILLIAM T. MARX** has been appointed director of personnel relations for *Raytheon Manufacturing Co.* . . . The promotion of **ALFRED H. GREBE** to the post of chief engineer for *Filtors, Inc.* has been made known . . . **C. G. HOLSCHUH,** president and general manager of the *Sperry Gyroscope Company,* division of *Sperry Rand Corp.,* has been elected a director of the corporation . . . *Finney Company* has announced the following appointments: **RICHARD LINNERT,** special sales engineer; **DONALD WELLS,** to direct activities of the firm's *"Models Unlimited"* research program; and **LYNN LOCKWOOD,** special factory representative . . . **WILLIAM C. BULLOCK** has joined the engineering staff of *G-L Electronics* . . . *Gramer-Halldorson Transformer Corp.* has appointed **R. E. COCHRAN** as vice-president in charge of the *Crawford Electronics Div.* **LARRY STINEMAN** has been named as chief engineer for the parent company . . . Three *Clevite Corporation* executives have been named division heads in a realignment of the company's domestic electronics activities. **JAMES D. LIGHTBODY** is now general manager of the electronics components division, **CURTIS B. HOFFMAN** is general manager of the *Brush Instruments Div.,* and **THOMAS J. LYNCH** has been named general manager of the ordnance division . . . *Alliance Manufacturing Co.* has named **GEORGE GEMBERLING** sales manager for the consumer products division. **RAY BUHRMAN** is now assistant sales manager for the consumer products division in addition to his duties as advertising manager . . . **WOODHAM W. CAULEY** has joined the staff of *ORRadio Industries, Inc.* as comptroller . . . **WILLIAM R. KILEY** has been named applications engineer by *Philips Electronics, Inc.* . . . **BOB HODGES** has been appointed sales engineer of the catalogue products division, *Chicago Standard Transformer Corp.* . . . **BLAKE KILBURN** has been appointed production manager of *Fisher Berkeley Corporation* . . . *Clevite Corp.* has established the post of vice-president, electronics, and **JAMES K. NUNAN** has been elected to the office . . . *Todd Products Company, Inc.* has appointed **RICHARD G. FREEMAN** as vice-president . . . **CECIL J. HARRISON** has been named vice-president of *Rixon Electronics, Inc.* . . . **ROBERT H. VREDENBURG** is now manager, eastern operations, of the marketing division of *American Electronics, Inc.* . . . **ARCHER W. RICHARDS,** chairman of the board and general manager of *Designers for Industry, Inc.,* passed away suddenly at the age of 72.

* * *

SEARC RADIO LIBRARY FOR THE BLIND, 11519 Parkview Ave., Cleveland 4, Ohio, is now in operation.

Sponsored by the South East Amateur Radio Club, Inc. of Cleveland and operated in part as a division of the Blind Services Committee of Tape-Respondents-International, this group acts as a clearing house for information on electronics literature in embossed and recorded form. It provides a depository for the receipt and circulation of Braille manuscripts and tape recorded readings of literature pertaining to all aspects of electronics in addition to its other services.

These facilities are available to blind persons in the U.S. and Canada. In order to remain self-supporting, the Library lists a nominal "handling charge" to defray its mailing costs.

* * *

NATIONAL HOME STUDY COUNCIL, the standard-setting agency for private correspondence schools, reports that two more home study schools in the electronics field have attained its accreditation. This brings to ten the total number of accredited schools offering study-by-mail courses in radio, television, and electronics.

In making the announcement the executive director of the 31-year old non-profit council commented that more home study students enroll in radio-television-electronics than in any other subjects. Throughout the nation nearly 20 per-cent of the million persons currently enrolled in correspondence courses are taking electronics subjects. —30—

ON SALE NOW!

only $1.00

(compiled by the editors of *Radio & TV News*)

Authoritative, comprehensive guide to hi-fi construction, maintenance and equipment . . . compiled by top authorities in the field. Includes complete instructions and plans for setting up your own system—covers preamps, equalizers, amplifiers, tape recorders, speakers, enclosures and stereophonic sound.

PARTIAL CONTENTS

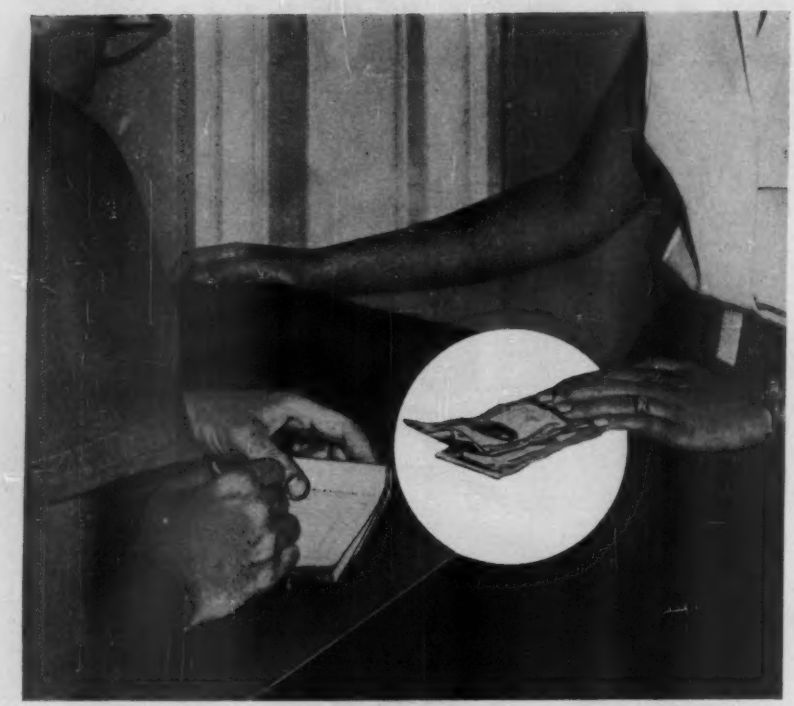
- ★ *Why's and wherefore's of room acoustics, speakers, enclosures.*
- ★ *How to buy and install preamps, equalizers, tone controls.*
- ★ *Do's and don'ts of amplifiers.*
- ★ *Latest techniques and ideas on stereophonic sound.*
- ★ *Tape recording ideas and recorder guidance.*
- ★ *Transistor hi-fi.*
- ★ *All about speakers and enclosures.*
- ★ *Building, servicing and improving hi-fi systems.*

LOOK FOR THIS *NEW* ZIFF-DAVIS PUBLICATION AT YOUR FAVORITE NEWSSTAND

Strategy for C.O.D. Service

By

ART MARGOLIS



The chief customer types who try to defer prompt payment and the techniques for discouraging them.

ABOUT a year ago the owner of a busy three-man TV service organization, a friend of the writer, was handed an ultimatum from his accountant. The accountant stated, "You either raise your service charge or cut out your credit business."

Delinquent accounts had reached a new high of twelve-hundred dollars. The expense of billing and special collection trips were eating deeply into the profits. Since his service charge was considerable already, the TV expert decided to go on the C.O.D. standard.

He quickly discovered there was one big problem with being strictly C.O.D. What do you do with the customers who still ask for credit? A strict adherence to refusal of credit was sending a percentage of his clientele elsewhere for TV service. He was faced with the enigma of how to give some customers a form of credit yet remain essentially on the C.O.D. standard.

Since the author's service outfit has always been C.O.D., the technician called on the writer with his problem. A long conference ensued and the harried operator was given a detailed description of a C.O.D. strategy that has been used successfully for years.

Experience shows that there are four definite types of set owners who ask for credit even though they know that business is transacted strictly on a C.O.D. basis.

The Careless Type

The writer ran into one of these only a couple of days ago. The TV was a three-way combination *Philco*. The set owner was a well-to-do elderly lady. The home was on the outer fringe of the service area. There was no audio, a weak picture, and slight vertical foldover.

A new 12BH7 vertical-output amplifier fixed the vertical foldover. A new 12AV7 perked up the picture, but that's all tubes would do: the audio still remained silent. The r.f. chassis was pulled out of the cabinet and the audio section inspected. Visually a slightly charred resistor was spotted. It was the "B+" dropping resistor in series with the screen of the 6AU6 audio i.f. (see Fig. 1). The ohmmeter read it as 6000 ohms instead of its called-for 25,000 ohms. It was replaced.

The chassis was hooked up and the TV turned on, still no audio. Evidently *something else* had burned up the resistor. A screen-to-ground resistance reading was taken. The meter read 4000 ohms. The schematic (Fig. 1) showed a 22,000-ohm resistor to ground and, in parallel with the resistor, was the power supply through the new 25,000-ohm resistor. The meter should have read no less than 10,000 ohms under these circumstances. The 22,000-ohm unit was disconnected. It was the culprit. It read 4000 ohms.

The "B+" dropping resistor had been electrocuted because the 22,000-ohm unit had shorted down, thus dragging a lot of current through both units.

The r.f. chassis was replaced and the audio sounded off. However, the damper was also replaced for arcing. The bill was unavoidably high. When the little old lady received the bill she said helplessly, "All I have home is five dollars. Whatever are we going to do?"

The writer carried out the strategy for the "careless" type. He collected the five and marked on the receipt the balance due. Under that sum he printed in large letters. "WILL MAIL IN 48 HOURS" and had her sign beneath it. He gave her the carbon. Then he handed her a stamped, addressed envelope and smilingly instructed her simply to put the cash, check, or money order in the envelope and drop it in the mailbox.

The click-click efficiency and tactful concern over the unpaid balance worked as it usually does. A check arrived the next morning. For these people who are simply careless enough not to have enough money around to meet their daily requirements, the collection message must be brought home strongly but not offensively. The readied envelope eliminates the obstacle of the customer having to make one up, and the signature imparts a strong sense of obligation and urgency. In the great majority of cases, the money arrives in the mail quickly.

The Suspicious Type

A second type of individual who asks for credit under all circumstances are those people with suspicious natures. They feel that if they can hold back payment for a length of time they have a weapon by which they can force a TV technician to stand behind his work. The suspicious types are hard nuts to collect from, but it can be done. The

technician has the job of instilling enough confidence in the customer to enable him to waive his hard rule of holding back payment.

A perfect "suspicious" type lugged his receiver into the shop the other day. He left his name, address, and telephone number and departed. After the set was repaired, the customer was called and arrived promptly.

He tried to pick up the TV but was handed the bill first. He said, "I'll mail the money in." When reminded of the shop's C.O.D. policy he blurted, "If the set works okay for a while you'll get your money; don't worry."

The writer tactfully went all through the facts that the work is guaranteed, that the company is bonded, and that even though the bill were paid the guarantee would be just as good. The gent stood firm. Since the TV was still in the shop, there was no problem—possession is "nine tenths!" However, insistence would have meant irritation and the loss of good will. The writer went into the strategy for suspicious customers.

"Sir," he said slowly, "You are going to mess up our bookkeeping by holding back the money." He took off his wrist watch. "If you don't trust me sir, here is my wrist watch. When you are satisfied with the repair you can bring it back."

The beefy fellow lost all his belligerency, paid the bill, shook hands amicably, and left with his set. This wrist watch has been offered many times—it has never been accepted yet.

The Professional Beat

Unfortunately there is a small percentage of people who believe that the word "credit" is synonymous with "free gift." They feel that if any firm is fool enough to give them an open account, that firm will just have to suffer the consequences.

A TV technician can spot these professional "beats"; they all tip their hand with the same routine. They do not mention a word about payment until the technician has fully completed his work. Then, after all the screws are back, the set is perking nicely, and the tool box is closed tight, they say, "I don't have no money."

The writer's outfit has a strategy reserved for this set of circumstances. It was used recently by one of the outside men. All of these outside men carry with them copies of a certain type of contract—an impressive looking legal paper—known as a "cognovit note." It is used only in extreme cases where it is obvious that the intentions of the customer are not honest. A copy of this document is shown in Fig. 2.

The cognovit note is an iron-clad note of indebtedness. It is a promise to pay a certain sum by a certain time. If the money is not paid, the undersigned confesses an automatic judgment in favor of the holder, waiving all legal rights. The undersigned also agrees to pay all costs and interests that accumulate in satisfying the note. If the note is signed and payment is not forthcoming on time, all that is necessary is to turn the note over to a constable, justice of the peace, or a collection agency. In this case the set owner, after reading what she had to sign, managed to get the money together. They usually do.

Honest Embarrassment

The fourth type of credit-seeking customer is one who honestly doesn't have the money to pay his bill. There is a method to extend these people a form of credit and practically eliminate all risks.

The writer used it this week on a 16" *Emerson* repair. One of the field men pulled it into the shop for lack of horizontal sweep. There was a bright, jagged stream of light that extended top to bottom on the screen. A schematic was pulled and troubleshooting started.

The horizontal circuits were examined first. They passed all resistance, voltage, and waveform tests. The trouble seemed to be somewhere past the horizontal output amplifier. The yoke and high voltage transformer were checked by tacking in new replacements. The new replacements didn't change the trouble in the slightest. All the components in the damper circuit were checked; every part was good. This one was weird.

The boosted "B+" was investigated. Everything checked satisfactorily. The only circuit that was left that could possibly cause this condition was the power supply. The schematic was perused to find a clue. It revealed there was an isolated filament winding in the low-voltage transformer for the damper. That is, it was supposed to be isolated.

A resistance check showed there was an 800-ohm short from this winding to ground. The transformer had to be replaced.

The bill was high. The set owner, after hearing the sad news said, "It's going to take me a month to pay the bill." Then he asked, "Is there any way I can get the set now?"

The set owner was asked if he had a checking account. He answered yes. The customer was then instructed to make out a check. He was informed that the check would be held a month before cashing it. All he had to do was cover the check by the time the month had elapsed.

The TV was then delivered, a check was paid for it, even though the check lay in a drawer for thirty days, and everybody concerned was happy.

It's been a year now since the owner of that three-man organization, mentioned at the beginning of this story, has been on the C.O.D. standard. Actual results show it has been a wise move. In comparison to the previous year's $1200 in delinquent accounts, this year's record didn't reach fifty dollars, and these few lost dollars can be directly traced to professional beats.

The volume of calls has increased. The owner attributes part of the increase to the "no-credit" policy. First of all, he claims that he has gained customers because he no longer loses his clientele by having to hound them for money. Also, he no longer loses clientele because they are ashamed to call him when they owe him money.

The fact that a TV service outfit is on the C.O.D. standard doesn't mean there are no longer any forms of credit. An outfit must bend a little to cater to the few inevitable requests. But each request will fall into one or overlap into a couple of the four types noted. If a TV company is prepared with stamped envelopes, a bit of dramatic salesmanship, official cognovit notes, or the holding check gimmick, the credit requests can mostly be satisfied without a loss of customers. —30—

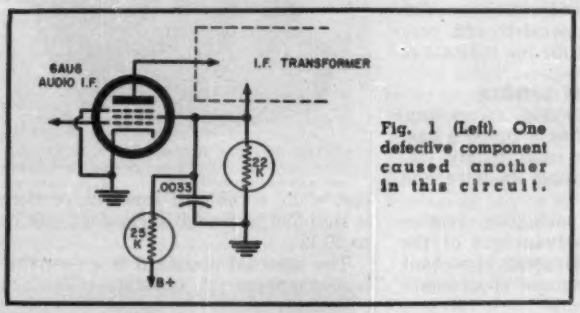


Fig. 1 (Left). One defective component caused another in this circuit.

Fig. 2 (Right). Those who appeal for credit with dishonorable intentions usually can be discouraged with the stringent legal form shown here.

COGNOVIT NOTE

$_____ DATE_____ 19____

FOR VALUE RECEIVED, I,_____

PROMISE TO PAY TO THE ORDER OF_____

THE SUM OF_____

TO BE PAID AS FOLLOWS:_____

_____

WITH INTEREST TO BE PAID, AT THE RATE OF_____ PER CENTUM PER ANNUM, FROM DATE PAYMENT IS DUE, AND_____ HEREBY AUTHORIZE ANY ATTORNEY AT LAW TO APPEAR IN ANY COURT OF RECORD IN THE UNITED STATES AFTER THE ABOVE OBLIGATION BECOMES DUE AND WAIVE THE ISSUING AND SERVICE OF PROCESS AND CONFESS A JUDGMENT AGAINST_____ IN FAVOR OF THE HOLDER HEREOF FOR THE AMOUNT THEN APPEARING DUE, TOGETHER WITH COSTS OF SUIT, AND THEREUPON TO RELEASE ALL ERRORS AND WAIVE ALL RIGHT OF APPEAL.

*Signed and Sealed in presence of:*_____ L.S.

_____ _____ L.S.

PLATE TRANSFORMER

Primary 110 V. 60 cy. 1½ KW. Secondary 2350-0-2350 V. AC @ 680 mils full wave by using two transformers. Each—Size: 7"x7"x7". Weight 40 lbs. each with Porcelain Insulator. **$24.95**

2 for .....
1 of above 2350 V. AC @ 340 MA ½ wave. Each $14.95

FILAMENT TRANSFORMER

Primary 110 volt 60 cycle. Secondary 2½ V. 10 amps 10,000 V. insulation. Suitable for pair of 866 tubes..... **$3.95**

OIL CONDENSER SPECIALS
BRAND NEW

2 MFD	600 VDC .50	2 MFD	2000 VDC 1.50
4 MFD	600 VDC .75	4 MFD	2000 VDC 3.50
6 MFD	600 VDC .85	2 MFD	2500 VDC 2.50
8 MFD	600 VDC .95	1 MFD	3000 VDC 1.85
10 MFD	600 VDC 1.10	4 MFD	3000 VDC 6.95
12 MFD	600 VDC 1.50	1 MFD	7500 VDC 6.95
1 MFD	1000 VDC .60	.5 MFD	7500 VDC 2.95
2 MFD	1000 VDC .85	2 MFD	10,000 VDC 39.95
4 MFD	1000 VDC 1.35	1 MFD	15,000 VDC 34.50
10 MFD	1000 VDC 2.95	1 MFD	25,000 VDC 69.50
1 MFD	1200 VDC .45	8 MFD	660 AC (2000 DC) 2.35
1 MFD	1500 VDC .75	16 MFD	660 AC. 2.95
2 MFD	1500 VDC 1.10		
6 MFD	1500 VDC 1.95		
8 MFD	1500 VDC 2.95		
10 MFD	1500 VDC 3.50		
24 MFD	1500 VDC 6.95		
1 MFD	2000 VDC .85		

CHOKE—FULLY CASED

10 HENRY 80 Mil (unshielded) ..... .90¢
6 HENRY 150 Mil $1.50
6 HENRY @ 200 Ma 1.95
10 HENRY @ 315 Ma. 3.50
3 HENRY @ 630 Ma 3.50
6 HENRY 450 Mil 4.95
8 HENRY 500 Mil 5.95
20 HENRY 500 Mil 9.95
7.5 HENRY 650 Mil (Thordarson com. series) 6.95

SIGMA 5F RELAY

16,000 ohm in dual 8,000 ohm coils. (Can be paralleled) SPDT adjustable silver contacts. Adjustable armature tension. Operates on 500 microamperes or less. Ultimate in a sensitive relay. Ideal for precision control work ..... ea. **$3.95**

Write for quantity prices.

REDMOND BLOWER

110V, 60 cyc. .5 Amp. 1600 Rpm. 3¼" Blower wheel—Outlet 2" Diameter. Suitable for cooling Transm. tubes, etc. ..... ea. **$7.95**
2 for $15.00

RELAYS

Sealed Claire SPST. Norm. closed 3000 ohm coil 4 ma. ..... ea. **95c**
Claire Telephone Type 11,300 ohm coil DPDT cont. 10 amp 125V. Sens. 4MA. ea. **$3.95**
Cutler Hammer Contactor—110V 60 cy. 4 pole s.t. Norm. open 25 amp contacts. ea. **$6.95**
Hermetically Sealed Relay Coil 110V AC 60 cy SPDT Contacts 5 Amps..... ea. **$1.85**
12 Volt DPDT DC Relay Each **$1.35**
Cramer Time Delay Relay, 230V 60 cy. 45 sec. adj. 2 pole DT..... ea. **$6.95**
G.E. Plug in Relay 8 prong 3000 ohm coil 4 mil. SPDT (Sigma 4F)..... ea. **$2.50**
Telephone type relay 12 V. DC @ 10 ma. triple pole single throw. Normally open. **$1.25**
Dynamotor Starting Relay, 12VDC 20 amp contacts **$1.50**
G.E. Relay control, contains 8000 ohm relay, sensitivity 2 mils. 10 for $9.25. ea. **$1.10**

AC VOLTMETER

3" 0-150 Volt. AC 60 cycle. Westinghouse and G. E. ..... ea. **$3.49**

MICROAMPERE METER

3" 0-50 Microamps. Scale 0-100 (50 Microamp scale supplied) SPECIAL..... **$6.95**

PANEL METERS

G.E., WESTINGHOUSE, W.E., SIMPSON, etc.

2" METERS		3" METERS	
0-1 Mil (Dual scale 0-500V. 0-1000 Ma)	3.49	0-100 Micro (Scale 0-3)	5.95
0-50 Micro DC	5.95	0-1 Mil 3.5 KV Scale	4.50
0-25 Ma DC	2.95	0-5 Mil DC	3.95
0-200 Ma DC	2.95	0-50 Mil DC	3.95
0-300 Mil DC	2.95	0-100 Mil DC	3.95
1-0-1 Amps DC....	2.95	0-300 Mil DC	3.95
0-5 Amps DC	2.95	0-1 Amp DC	3.95
0-25 Amps DC ...	2.95	0-25 Amp DC	3.95
0-50 Amps DC ...	2.95	50-0-50 Amp DC ..	4.50
18-36 Volts DC...	1.99	0-50 Volts DC ...	3.95
0-50 Volts DC ...	2.95	0-500 Volts DC ...	4.50
0-300 V. DC	3.25	0-1 KV DC	5.00
0-4 Amps RF	2.95	0-2.5 KV DC	5.50
		0-7.5 V. AC	3.95
		0-30 Amps RF with Ext. Thermocouple	12.95

MISCELLANEOUS SPECIALS
NON-INDUCTIVE RESISTORS

100 ohm 100 watt..... 2 for $1.75
50 ohm 6 watt..... ea. 35¢

HEINEMANN CIRCUIT BREAKER
AM12MT 110V. 60 cy 20 Amps..... ea. $1.10

All merchandise sold on a 10 day money back guarantee basis

Min. Order $3.00—25% with Order—F.O.B. New York

PEAK
ELECTRONICS COMPANY
66 W. Broadway, New York 7, N. Y., WO-2-5439

What's New in Radio

"SUPER TUBE CADDY"

Argos Products Company, Genoa, Ill. is now offering a new "Super Tube Caddy," the Model TC-5.

Capable of carrying a third more tubes than the company's largest unit to date, the TV-4 "Carry-all," the new unit has over 3300 cubic inch volume with a separate removable tool tray. It is designed for the technician who would rather do more jobs on the spot than lug a chassis into the shop.

The caddy will accommodate numerous tubes, tools, soldering gun, meter, and accessories. It measures 24" wide, 16½" high, and is 8½" deep. It is covered in a durable extra-heavy pyroxylin fabric.

CAPACITOR TESTER

Heath Company of Benton Harbor, Mich. is now offering a modestly priced capacitor tester which is designed to be used in in-circuit trouble-shooting.

With the Model CT-1 it is possible to check most capacitors for opens or shorts without removing the component from the circuit. The tester will detect opens from about 50 μμfd. up as long as the capacitor is not shunted by an excessively low resistance value. It will detect shorted capacitors up to 20 μfd. when not shunted by less than 10 ohms.

The circuit incorporates 60 cycle and 14 megacycle test frequencies. The instrument is a.c. operated and uses an electronic "eye" tube for indication.

SQUARE WIRE SPOOLS

Belden Manufacturing Company, Chicago 80, Illinois has adopted a new square spool as the most highly efficient way of packaging its wire and cable.

This method of packaging retains the tried and true advantages of the round spool and adds some important new features. The square spool won't roll off the shelf or work table. It also presents a much neater appearance when displayed on a rack.

Added protection for the wire is provided by a clear vinyl plastic covering which allows easy identification of the wire.

TRANSISTOR MILLIVOLTMETER

Burr-Brown Research Corporation, Box 6444, Tucson, Arizona is now offering an a.c. millivoltmeter which features completely transistorized circuitry.

The Model 300 provides an input impedance of 2 megohms without use of vacuum tubes; battery life of 4500 hours; twelve ranges covering .001 to 300 volts full scale; frequency response from 8 to 800,000 cps; regulated power supply system; and small size.

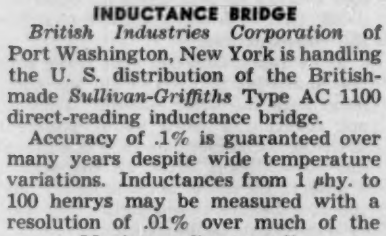
The unit measures 5" x 7" x 5" and has a 4" meter. The meter can be powered with either ordinary flashlight cells or with mercury batteries.

Write the manufacturer direct for a copy of Catalogue Sheet No. 300 which gives full details on this instrument.

INDUCTANCE BRIDGE

British Industries Corporation of Port Washington, New York is handling the U. S. distribution of the British-made *Sullivan-Griffiths* Type AC 1100 direct-reading inductance bridge.

Accuracy of .1% is guaranteed over many years despite wide temperature variations. Inductances from 1 μhy. to 100 henrys may be measured with a resolution of .01% over much of the range. Maximum direct-reading accuracy is achieved between 50 and 3000 cps, while a table of small corrections is supplied to permit measurements up to 20 kc.



The internal standard is a temperature-compensated, constant-resistance,

cently introduced a handy transistor

The filament coil of the new 1B3GT

Seeing Double?

SURE . . . THEY LOOK ALIKE BECAUSE THEY ARE EXACTLY ALIKE

Each Merit product of the same type is exactly the same as another—both in construction and appearance.

COMPARE IT WITH MERIT

Take a Merit product off the shelf. Compare it with any other similar product on the market. You'll find Merit *is* superior!

COMPARE IT WITH
MERIT
MERIT COIL & TRANSFORMER CORP.
4427 N. CLARK ST., CHICAGO 40, ILLINOIS

38% DISCOUNT on all **LONG PLAYING RECORDS**

You save $1.51 to $2.85 on every record you buy

A $3.98 record costs you $2.47
A $4.98 record costs you $3.09
A $5.98 record costs you $3.70
NO MINIMUM PURCHASES EVER

The World's Largest Record Dealer

Sam GOODY

Goody Record Club offers a 38% DISCOUNT on selected list of best-selling records (over 1000 titles, and growing) — pops, jazz, classics, opera, shows, etc. A new list sent you every month — Buy as few or as many as you want.

FREE—when you join the club, your choice of any one available record (list priced to $7.50) and one set of 2-volume 350-page LONG PLAYER catalog.

Membership dues $12.00 a year, payable in advance. If not satisfied, your money back within 60 days (less selling price of free record), if you purchase no records from the club.

SPECIAL TRIAL OFFER: ONE ORDER FILLED WITHOUT OBLIGATION TO JOIN THE CLUB. We will fill one order, any available longplay records (any quantity), at 38% discount. Add 10% for mailing, handling charges.

JOIN THE GOODY RECORD CLUB NOW AND SAVE!!!

make check or money order payable to: Sam Goody Record Club Inc.
250 West 49 Street, N.Y. 19, N.Y.

Please enroll me for one year, and rush to me all club literature. I enclose $12 ☐ Check ☐ M.O.

Name.....
Address.....
City & State.....

FREE DETAILED INFORMATION ON REQUEST

4-dial inductance of .05% accuracy. Five decade switches and one continuously variable dial provide direct-reading measurements of both a.c. and d.c. resistance.

Write Department K30 of the company for full details on this laboratory instrument.

"LOCTITE" SEALANT

American Sealants Company, 103 Woodbine St., Hartford 6, Conn. has developed a new sealant which stops nuts from loosening.

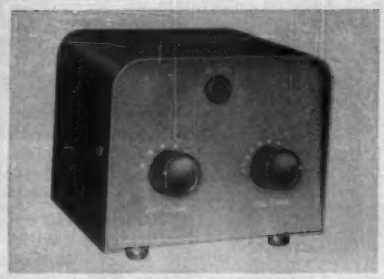
Suitable for a wide variety of equipment applications, "Loctite" is a thin liquid that locks metal to metal. It wicks into threads between the nut and bolt and hardens automatically in 12 hours to form a tough, plastic bond which grips. The sealant hardens only in the absence of air. It is 100 percent active and contains no solvents to evaporate. Although shake-proof from the most severe vibration, nuts can be removed with ordinary tools, re-treated and re-used.

"Loctite" comes in a 2 cc squeeze tube good for 100 applications. It is being merchandised through hardware stores and outlets catering to the "do-it-yourself" home owner and hobbyist.

NEW WRL HAM UNITS

WRL Electronics, 34th and Broadway, Council Bluffs, Iowa has announced four new products which will be released to the amateur radio market this winter.

The unit pictured is the "Globe



Matcher, Jr.", an antenna tuner catalogued as the Model AT-3. It is designed to operate with any transmitter with a power input of 100 watts or less. It provides a substantial amount of second harmonic attenuation when properly tuned. It aids in matching the transmitter output to various types of antennas.

The tuner is housed in a steel cabinet for TVI prevention. It is completely self-contained and measures 5"x4"x4". It is offered in both kit and wired forms.

The other equipment now available or to be offered shortly are the "Globe Matcher, Sr." (Model AT-4); a class B and C linear amplifier (Model LA-1); and a universal modulator (Model UN-1). Write the company for information on any or all of these new items for the radio amateur.

TRANSISTOR TESTER

Century Electronics Co., Inc., 111 Roosevelt Ave., Mineola, N. Y. has re-

Your choice of school is highly important to your career in

INDUSTRIAL ELECTRONICS

RADIO-TELEVISION

ELECTRONICS COMMUNICATIONS

Become an **ELECTRICAL ENGINEER** *or an* **ENGINEERING TECHNICIAN** *at*

MSOE *in Milwaukee*

Choose from courses in:

ELECTRICAL ENGINEERING
Bachelor of Science Degree in 36 months—
Communications or
Electrical Power.

ENGINEERING TECHNOLOGY
Associate in Applied Science degree in 18 months—
Electronics Communications
Electrical Power or Computers.

MSOE—located in Milwaukee, one of America's largest industrial centers—is a national leader in electronics instruction—with complete facilities, including the latest laboratory equipment, visual aid theater, amateur radio transmitter—offers 93 subjects in electrical engineering, electronics, radio, television, electrical power, and electricity.

Advisory committee of leading industrialists. Courses approved for veterans. Over 50,000 former students. Excellent placement record. Previous educational, military, and practical experience is evaluated for advanced credit.

QUARTERS BEGIN SEPTEMBER, JANUARY, MARCH, JULY

Choose wisely—your future may depend on it. Mail coupon today!

MILWAUKEE
SCHOOL OF ENGINEERING
Dept. RT-1257, 1025 N. Milwaukee St.
Milwaukee, Wis.
Please send free illustrated career booklet (please print)

I'm interested in.....
Name..... Age.....
Address .....
City..... State.....
Are you eligible for veterans educational benefits? .....
Discharge date .....
MS-57

Known as "TV Tone," the new unit's input consists of a small loop antenna, embedded in plastic, which may be

Build 16 Radio **$22.95**

QUALITY CUT QUARTZ

FOR EVERY SERVICE

All crystals made from Grade "A" imported quartz—ground and etched to exact frequencies. Unconditionally guaranteed! Supplied in:

FT-243 holders
Pin spacing ½" pin diameter .093

DC-34 holders
Pin spacing ¾"
Pin diameter .156

MC-7 holders
Pin spacing ¾"
Pin diameter .125

FT-171 holders
Pin spacing ¾"
Banana pins

MADE TO ORDER CRYSTALS

1001KC to 2500KC:
.01% Tolerance..$1.75 .005% Tolerance..$2.50

2501KC to 9000KC:
.01% Tolerance..$1.50 .005% Tolerance..$2.50
Specify holder wanted.

ANY AMATEUR BAND CRYSTAL
.05% Tolerance
NOVICE BAND CRYSTALS
80 meters 3701-3749KC
40 meters 7152-7198KC
15 meters 7034-7082KC
99¢ each

6 METER TECHNICIAN BAND CRYSTALS

SEALED OVERTONE CRYSTALS supplied in metal HC/6U holders—pin spacing .486, diameter .050.
10 to 30 MC .005 tolerance.....$3.85 ea.
30 to 54 MC .005 tolerance.....$4.10 ea.
55 to 75 MC .005 tolerance.....$4.25 ea.
75 to 90 MC .005 tolerance.....$5.50 ea.

STOCK OVERTONE CRYSTALS in FT-243 holders $1.00. Frequencies listed in megacycles:

15.01	16.7	17.15	18.225
15.11	16.8	17.16	18.325
16.335	16.9	18.025	18.475
16.435	17.0	18.125	18.925

MARINE FREQUENCY CRYSTALS
All marine frequencies from 2000-3200KC
.005 tolerance $2.50
(Supplied in either FT-243, MC-7, or FT-171 holders.)

RADIO CONTROL CRYSTALS
27.255 MC sealed crystals.....$2.50 ea.

Stock crystals in FT-243 holders from 5675KC to 8650KC in 25KC steps.....50¢

FT-241 lattice crystals in all frequencies from 370KC to 540KC.....50¢
Matched pairs ± 25 cycles $2.50 per pair.

200KC Crystals...$2.00 500KC Crystals...$1.00
455KC Crystals...$1.00
1000KC Frequency Standard Crystals.....$3.50
Dual Socket for FT-243 Crystals.....$ .15
Ceramic socket HC/6U Crystals.....$ .15

ASK YOUR LOCAL PARTS DISTRIBUTOR FOR TEXAS CRYSTALS . . . LOOK FOR THE YELLOW AND RED DISPLAY BOARD.

(Add 5¢ per crystal for postage and handling.)
WRITE FOR CATALOG AND QUANTITY PRICES.

Texas Crystals
The Biggest Buy in the U.S.
8538 W. GRAND AVENUE · RIVER GROVE, ILL.
ALL PHONES—GLADSTONE 3-3555

Terms: All items subject to prior sale and change of price without notice. All crystal orders MUST be accompanied by check, cash or M.O. WITH PAYMENT IN FULL. NO C.O.D.s. Postpaid shipments made in U.S. and possessions only. Add 5¢ per crystal for postage and handling charge.

cently introduced a handy transistor tester which is being offered in either kit or wired form.

The Model TT-2 will check current gain, leakage, opens, shorts, cut-off

current in transistors and diodes for forward-to-reverse gain. The unit is powered by an easy-to-replace 6-volt battery. The burn-out-proof 3" meter is rugged yet sensitive. The multi-color scales are designed for quick, easy readings. The unit is engineered so that it cannot damage the transistor or diode under test, nor can it drain the battery due to accidental shorting of test leads.

Write the manufacturer direct for full details on either version of this servicing test aid.

MIRROR-SCALE V.O.M.

Precision Apparatus Company, Inc., 70-31 84th St., Glendale 27, N. Y. has

added a high-sensitivity, multi-range v.o.m. to its line of test equipment for industrial and service applications.

The Model 120M features multipliers with a ± .5% tolerance; 1% accuracy meter which provides ± 1½% accuracy on all d.c. functions and ± 3% accuracy on all a.c. ranges; and a separate function selector position of −d.c. volts and −d.c. milliamps. Polarity is reversed by means of the function switch.

Sensitivity is 20,000 ohms-per-volt d.c. and 5000 ohms-per-volt a.c. There are 44 ranges included in the circuit. A 5¼" meter with full 4¾" window for greater visibility permits accurate readings on the mirrored scale. The Model 120M is housed in a molded phenolic case which measures 5⅜"x 7"x3½".

HOOKED-FILAMENT TUBE

The Tube Department of *Sylvania Electric Products Inc.*, Emporium, Pa. has announced a new improved version of the 1B3GT half-wave rectifier tube. Designed with a hooked filament coil, the new tube is said to combine longer life with higher and more stable emission characteristics.

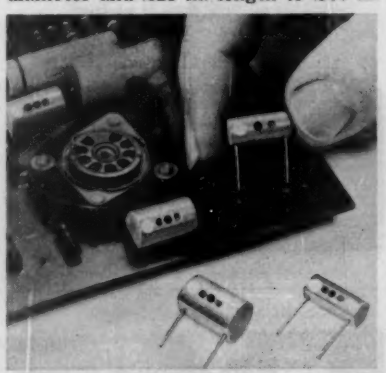
The filament coil of the new 1B3GT is held in position by an insulated hook latched directly to the center of the filament. Filament bowing is thus virtually eliminated since the pulling force of the electrostatic field around the filament is cut in half. In addition, because the filament is held firmly in position by the hook, vibration of the coil is minimized. This factor prevents filament coating from shaking loose, a condition which causes arcing between elements.

RADIAL LEAD COILS

Delavan Electronics of East Aurora, N. Y. is now offering a complete series of 42 radial lead coils in inductances ranging from .47 to 10,000 μhy.

Each coil is hermetically encapsulated in molded alkyd plastic making it possible for the coils to conform to MIL-C-15305A specifications. There is a flat base molded in the body of each coil at the lead exit to permit snug and secure placement of coils on printed circuit boards. The radial leads are suitable for either automation equipment or hand insertion. Leads are spaced at .100 inch increments for the customer's convenience.

The coils range in size from .235 in. diameter and .625 in. length to .500 in.



diameter and .825 in. length with five different mold sizes available. Write the manufacturer for details on coils to meet specific requirements.

"THE TEENYFORMER"

Gramer - Halldorson Transformer Corporation of Chicago has announced production of a microminiature transformer which is being marketed as the "Teenyformer."

The unit is so small that it is completely hidden by the normal lead pencil eraser. Its actual dimensions are .203" x .297" x .297". It takes 700 of the transformers to tip the scale at a pound.

Designed for transistor applications, the "Teenyformer" is the eighth unit in the firm's line of transformers designed especially for such circuitry.

"TV TONE"

Tapetone, Inc., 10 Ardlock Place, Webster, Mass. has developed a compact unit designed to permit the audio portions of television programs to be fed into a high-fidelity sound system to improve reproduction.

The new line is packaged in a con-

Known as "TV Tone," the new unit's input consists of a small loop antenna, embedded in plastic, which may be placed inside or under the television chassis. The antenna picks up the 4.5 mc. signal from the intercarrier set, preferably from a location near the audio detector tube. A shielded cable on the pickup unit carries the signal to the hi-fi preamp or amplifier-speaker system.

The unit is a.c. powered and measures 11"x4"x4½". It is housed in a grey metal cabinet.

5-INCH CRO KIT

Paco Electronics Company, Inc., 70-31 84th St., Glendale, N. Y. has announced the availability of a new 5-inch cathode-ray oscilloscope in kit form, the Model S-50.

Designed especially for the radio and TV servicing industry, the circuit features push-pull vertical and horizontal amplifiers, printed-circuit amplifier design, a high-sensitivity 1 mc. vertical amplifier, a built-in 1 volt peak-to-peak self-calibrator, and an easy-to-read panel.

Housed in a rugged, louvred steel cabinet, the CRO measures 13⅜" x 8¾" x 17¼". Accessories include a set of three probes: low capacity, demodulator, and direct types. Write the manufacturer for prices and delivery details.

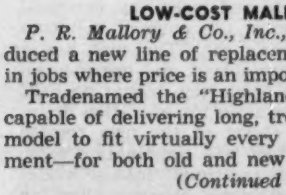
LOW-COST MALLORY VIBRATORS

P. R. Mallory & Co., Inc., Indianapolis, Ind. has introduced a new line of replacement vibrators for application in jobs where price is an important factor.

Tradenamed the "Highlander" line, the new units are capable of delivering long, trouble-free service. There is a model to fit virtually every standard auto radio requirement—for both old and new receivers.

(*Continued on page* 168)

The NEW YEATS "Shorty"
STATION WAGON & PANEL PICK-UP
appliance dolly



YEATS Model No. 5
Aluminum alloy
Height 47"
Weight 32 lbs.

Only 47" tall, this new YEATS dolly is designed for TV and appliance men who make deliveries by station wagon or panel truck. No need to detach appliance for loading into the "wagon" or pick-up . . . the YEATS "Shorty" will slide into your vehicle with ease. Has aluminum alloy frame with padded felt front, quick fastening (30 second) strap ratchet, and endless, rubber belt step glide. New YEATS folding platform attachment, at left, saves back-breaking work handling TV chassis or table models. Call your YEATS dealer today!

Folding platform is 13½" x 24½"—attaches instantly. (Platform only) $9.93.

"Everlast" COVERS & PADS

YEATS semi-fitted covers are made of tough water repellant fabric with adjustable web straps and soft, scratchless white flannel liners. All shapes and sizes—Write.

Furniture Pad

TV Cover

SEND postcard for full information on our complete line TODAY!

YEATS appliance dolly sales co.
2101 N. 12th St. Milwaukee 5, Wis.

Build 16 Radio CIRCUITS at Home with NEW DELUXE 1958 PROGRESSIVE RADIO "EDU-KIT"

Only $22.95 Reg. U.S. Pat. Off.

A Practical Home Radio Course

★ No Knowledge of Radio Necessary
★ No Additional Parts or Tools Needed
★ Excellent Background for TV
★ School inquiries invited
★ Attractively Gift Packed

Now Includes
★ TRANSMITTER
★ SIGNAL TRACER
★ SIGNAL INJECTOR
★ CODE OSCILLATOR

FREE SET OF TOOLS, PLIERS—CUTTERS, TESTER, SOLDERING IRON, ALIGNMENT TOOL

WHAT THE "EDU-KIT" OFFERS YOU

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction, servicing, basic Hi-Fi and TV repairs, code, FCC amateur license requirements.

You will learn how to identify radio symbols, how to read and interpret schematics, how to mount and layout radio parts, how to wire and solder, how to operate electronic equipment, how to build radios. You will receive a basic education in radio, worth many times the small price you pay, only $22.95 complete.

THE KIT FOR EVERYONE

The Progressive Radio "Edu-Kit" was specifically prepared for any person who has a desire to learn Radio. The "Edu-Kit" has been used successfully by young and old in all parts of the world, by many Radio Schools and Clubs in this country and abroad. It is used for training and rehabilitation of Armed Forces Personnel and Veterans throughout the world.

. .The Progressive Radio "Edu-Kit" requires no instructor. All instructions and parts are included. Every step is carefully explained. You cannot make a mistake.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore, you will construct radio circuits, perform jobs and conduct experiments to illustrate the principles which you learn.

You begin by examining the various radio parts included in the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set, you will enjoy listening to regular broadcast stations, learn theory, practice testing and troubleshooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

Included in the "Edu-Kit" course are sixteen Receiver, Transmitter, Code Oscillator, Signal Tracer, and Signal Injector circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

In order to provide a thorough, well-integrated and easily-learned radio course, the "Edu-Kit" includes practical work as well as theory; troubleshooting in addition to construction; training for all, whether your purpose in learning radio be for hobby, business or job; progressively-arranged material, ranging from simple circuits to well-advanced topics in Hi-Fi and TV. Your studies will be further aided by Quiz materials and our well-known FREE Consultation Service.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build 16 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, instruction Manuals, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio & Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C.-type Questions and Answers for Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book.

TROUBLE-SHOOTING LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of troubles in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the Dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

J. Statatis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a Course, but I found your ad and sent for your Kit."

FREE EXTRAS
• SET OF TOOLS • RADIO & ELECTRONICS TESTER • ELECTRIC SOLDERING IRON • TESTER INSTRUCTION MANUAL • MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • HI-FI GUIDE • QUIZZES • TV BOOK • FCC AMATEUR LICENSE TRAINING • RADIO BOOK • PRINTED CIRCUITRY

90 DAY UNCONDITIONAL MONEY-BACK GUARANTEE

ORDER FROM AD—RECEIVE FREE BONUS RESISTOR AND CONDENSER KITS WORTH $2.00

☐ Send "Edu-Kit" Postpaid. I enclose full payment of $22.95.
☐ Send "Edu-Kit" C.O.D. I will pay $22.95 plus postage.
☐ Send me FREE additional information describing "Edu-Kit." Include FREE valuable Radio and TV Servicing Literature. No obligation.

Name .....
Address .....
.....

PROGRESSIVE "EDU-KITS" INC. 497 Union Ave., Room 72E, Brooklyn 11, N. Y.

Fresh design ideas, new engineering concepts are combined in AMPHENOL's Vi-Fi indoor TV antenna.

VIDEO FIDELITY is here! "Slide Rule tuning and transformer coupling for strong, sharp pictures in difficult reception areas—no complicated switches!

SLENDER LINE STYLING Vi-Fi is as thin and as modern as the new TV sets—no bulk, no mass!

THREE WAY MOUNTING versatility: On top, and hidden or flush on back—no limitations!

Vi-Fi is available in VHF and VHF/UHF models, and in three color choices. It took two years to bring Vi-Fi to its present perfection—it will take you only two minutes to appreciate its many new advantages.

See your AMPHENOL Distributor for complete details.

AMPHENOL ELECTRONICS CORPORATION
chicago 50, illinois

The new line is packaged in a convenient "10-pack," housing ten units in a handy carry-carton. The "Highlanders" are being handled through the company's regular distributors.

"GENIE LIFT-A-DOR"

A new radio controlled garage door operator which cannot be triggered by accident and which requires no FCC license has been introduced by *The Alliance Manufacturing Co., Inc.*, Alliance, Ohio.

Called "Genie Lift-A-Dor," the device automatically unlocks, opens, lights, closes, and locks any overhead garage door at the push of a button in the owner's car. The unit has a limited range output and operates on a low radio frequency so that no FCC license is required for operation or installation. Heart of the new remote control system is a combination radio carrier wave and signal impulse modulator, which work together like an electronic combination lock.

To protect children and pets, the unit features a safety clutch which stops the door at the slightest interference. All units are easily demountable for transfer when moving or changing cars. The garage door operator is sold through home improvement dealers.

LOW-COST TRANSISTOR RADIO

The *Regency Division* of *I.D.E.A., Inc.*, Indianapolis, Ind. is now marketing a new, all-transistor radio which is priced at under $30.00.

The Model TR-4 incorporates a superheterodyne printed circuit, an Alnico V super-dynamic, acoustically balanced speaker, and long-life transistors. The new receiver measures only 3" x 5" x 1¼" and weighs only 12 ounces. The impact plastic case comes in mandarin red, black, and ivory with silver dial and silver trim.

The receiver covers the entire broadcast band and includes marked Conelrad positions.

-30-

AN/APR URF receiver 28-4000 Mc. precision receiver utilizing 5 tuning units with direct reading dials in Mc. Receiver has a wide and narrow band width 30 Mc. I.F. strip which may be selected

various components called for in the construction sections are of European

Mac's Service Shop

"ANALYTICAL DESIGN OF LINEAR FEEDBACK CONTROLS" by George C. Newton, Jr., Leonard A. Gold & James F. Kaiser. Published by *John Wiley & Sons, Inc.*, New York, 419 pages. Price $12.00.

This is a presentation of analytical techniques for solving practical control problems through the use of simplified models and constraints.

Included is a comprehensive discussion of analytical design procedure for systems which must handle transient input signals and for those to which stochastic signals, that is, those having a degree of randomness are applied.

* * *

"SYNTHESIS OF PASSIVE NETWORKS" by Ernst A. Guillemin. Published by *John Wiley & Sons, Inc.*, New York, 741 pages. Price $15.00.

This volume presents the complete theoretical basis for linear passive synthesis procedures.

Prof. Guillemin, a widely recognized authority on electrical network theory and analysis, covers—without "short cuts"—both the approximation problem and the realization techniques. The procedures are detailed sufficiently and enough problems and examples are included so the reader may proceed to independent work in the field.

* * *

"BASIC PHYSICS" by Alexander Effron. Published by *John F. Rider Publisher, Inc.*, New York, 677 pages. Price $7.60. (Vols. 1 & 2 bound together.)

This two-volume textbook, encased in a single binding comprises a full year's course in physics at the intermediate or high-school level. It can be used either as a classroom text or for independent home study since the approach, organization of material, and presentation are progressive.

The first twenty-one chapters which comprise Volume 1 offer an over-all picture of the science and simplest possible exposition and explanation of the principles involved. The remaining twenty chapters which make up the second book provide a more advanced and analytical treatment of the concepts and theories which were touched upon in the earlier volume.

The author has used almost 800 illustrations (photographs, line drawings, graphs, charts, etc.) to amplify and clarify the text material. His style is informal which makes for ready assimilation of the subject matter. Each chapter carries questions and problems.

* * *

"DRY BATTERY RECEIVERS WITH MINIATURE VALVES" by E. Rodenhuis. Published by *Philips Technical Library*, Eindhoven, Netherlands. 230 pages plus 8 separate schematics. Price $4.95.

This newest volume in the popular *Philips'* Technical Library series should make a hit with both hobbyists and technicians for it deals with the home construction of modern battery radio receivers.

Included is design data as well as information on the repair and troubleshooting of battery-operated sets. Written in simple language and without resorting to involved mathematics, the author has presented his subject matter in interesting and usable fashion. Circuits covered include AM-FM, short-wave, and broadcast types. The schematics are for a 5-tube battery-a.c.-d.c. receiver; a 4-tube battery set using a 90-volt supply; a 4-tube set which operates from a 67.5 volt battery; a simple 4-tube receiver using D96 type tubes; a 5-tube battery-a.c.-d.c. set with D96 tubes and a tuning indicator; an AM-FM receiver for battery or a.c. operation and using 6 tubes; a 7-tube AM-FM unit; and a high performance battery receiver. The tubes specified are all of the type made by *Philips of Holland* while the

A low-cost high-use gift

FOR HOBBYISTS
HAMS AND EXPERIMENTERS
HI-FI ENTHUSIASTS

only $7.95 list

MODEL 8100K

Weller SOLDERING KIT

featuring the famous **WELLER** Soldering Gun

Here's a gift that'll bring a hearty "thanks" from any man who receives it this Christmas. For the Weller Soldering Kit means quick, easy, expert soldering . . . even for the amateur. The Weller Soldering Gun heats instantly, has fingertip "on-off" control and dual spotlights. Over 100 watts, it's UL approved and guaranteed for 1 year. Gift packaged kit also includes cleaning brush, soldering tool and solder.

Professional, Heavy-Duty Weller Soldering Guns up to 275 Watts $13.50 list and up

Weller Heavy-Duty Soldering Kit in Sturdy Metal Storage Case $14.95 list

Order for Christmas from your electronic parts distributor

WELLER ELECTRIC CORPORATION
601 Stone's Crossing Road, Easton, Pa.

"Okay, okay!" Barney exclaimed as he threw up his hands in surrender. "I take it all back! You've convinced me

AN/APR UHF receiver 28-4000 Mc. precision receiver utilizing 5 tuning units with direct reading dials in Mc. Receiver has a wide and narrow band width 30 Mc. I.F. strip which may be selected at will. 110 V AC. 60-2600 cycle.
Brand New $89.50
Tuning units for above.
TN 16/38-95 Mc. ..... Exc. $59.50
TN15/T4-320 Mc. ..... Exc. $49.50
TN 18/300-1000 Mc ..... Exc. $79.50

BC-659 FM Receiver-transmitter, xtal controlled, two channels, freq. range 27-38.9, 9 Mc, 13 tubes, built-in speaker, dual meter for testing filament and plate circuits. Exc. **$14.95**

BC 620
Same as above except less spkr. and 20 to 27 Mc..... **$6.95**

BC 603 Ten Channel Push-button or continuous tuning FM RECEIVER 20 to 28 Mc complete w/tubes, speaker, squelch circuit, 12 volt power supply. Exc..... **$14.95**
BC 683. Same as above except 27 to 38.9 Mc..... **$24.95**

BC 604—10 Channel, 30 Watt Crystal Controlled 20 to 27 Mc Transmitter. Complete with tubes and 24 Volt Dynamotor. Ship. wt. 80 lbs. **$9.95**
Exc. .....
F.O.B. Chicago or Sacramento, Calif.

ATR—11 TRANSCEIVER 2.5 Mc to 6.7 Mc complete w/12 tubes. **$29.50**
Exc. .....
12 Volt Dynamotor for above..... $14.95
Both units for..... 39.50

RA-10DB—9 TUBE SUPERHET
Rec. 150 Kc-1100 Kc 2 Mc to 10 Mc in four Bands. Exc..... **$24.50**

Bendix 100 Watt Transmitter
Easily converted to 10-20-40-80 Meters. Has four separate output tanks. One 4 position selector which changes the ECO IPA and output tank simultaneously. Uses 2—807, 4—**$22.95**
12Sk7. Complete w/tubes..... ea.

MP-28 modulation and Power supply for the TA-12 transmitter. Complete with 4 tubes. Dynamotor has an output of 540 V. DC @ 450 ma. Input at 28 V. DC. **$14.95**
With dynamotor. .....

3 CM-X Band Airborne Search Radar
Brand new RECEIVER and TRANSMITTER complete with Parabolic Antenna; Azimuth 75° each. Direction 150° complete with amplifiers, indicators, control box, less junc. box, connectors.
Tube complement consists of:

2 ea.—723AB	30 ea.—6J6	1 ea.—725A
2 ea.—1822	9 ea.—6V6GT	1 ea.—807
4 ea.—3B24	11 ea.—6AK5	1 ea.—VR105
2 ea.—3FP7	4 ea.—6SL7GT	4 ea.—VR150
3 ea.—5U4	2 ea.—724A	

(govt. asquis. cost over $4000.00). Ship. wt. 431 lbs. w/operating instructions. **$69.50**
YOUR SPECIAL PRICE. .....
F.O.B. Penna. warehouse.

TRANSCEIVER, only Exc. $39.50
Parabolic Antenna only..... 14.95
60-TRANSCEIVER TUBES 29.95
60 MC IF Strip w/tubes..... 4.95
MAGNETRON MAGNET Approx.
1800 Gauss ..... ea. 7.95

LM FREQUENCY METER
Heterodyne, crystal calibrated, modulated with calibration book 125KC to 20,000KC—Exc. ..... ea. $49.50
less calibration book—$29.50

DuMONT LAB—Oscilloscope
Type 224..... Exc. **$59.50**

T-20, 4 to 5.3 MC—T-21, 5.3 to 7 MC. Used..... $3.95 NEW $5.95
3 to 4 mc. like new..... $5.95
T-23 100-156 MC New $13.95
Used 7.95

BC 923 MOBILE FM RECEIVER, 27-38.9 MC
Complete with built-in loudspeaker, squelch control, speaker phone switch, sensitivity control, variable (Permeability) tuning for each channel of 4 channels permits pre-setting of 4 frequencies. Exc.... $34.50
MODULATOR ..... with tubes . . . 2 ea. 813; 1 ea. 807; 1 ea. 5R4; 2 ea. 6AG7; 1 ea. 6D4. EXC. Ship. wt. 60 lbs. $14.95
813, $6.95 ea., 2 for $10.00; 807, 98¢; 6AG7, 49¢; 5R4, 49¢.

WRITE FOR NEW BULLETIN
25% Deposit required with orders

R W ELECTRONICS
2430 So. Michigan Ave., Chicago 16, Ill.
Dept. N, PHONE: CAlumet 5-1281-2-3

various components called for in the construction sections are of European origin. Suitable U. S. equivalents could undoubtedly be obtained for parts not directly imported into this country at the present time.

* * *

"FM STATIONS UP-TO-DATE" compiled by Bruce G. Cramer. *Audiocraft Magazine,* Great Barrington, Mass. 8 pages. Price 50 cents. Paper bound.

A number of our readers have inquired as to the availability of a listing of FM broadcast stations which, since the demise of "White's Radio Log," has been hard to find.

This compact 8-page publication lists FM stations by city and state, call letters, channel, frequency, power, antenna height, latitude and longitude, and network affiliation, if any. Canadian FM stations have also been included.

For those who enjoy trying to "DX" such transmissions or wish such a listing for other purposes, this little booklet should certainly meet their requirements.

* * *

"ELECTRONIC SHORTCUTS FOR HOBBYISTS" by Semiconductor Div. Staff. Published by *Sylvania Electric Products Inc.,* New York. 44 pages. Price 35 cents. Paper bound.

This booklet contains 24 simplified crystal diode circuits designed especially for the home hobbyist, experimenter, and model maker.

The projects discussed and described range from an interval timer, through a low-current relay circuit and radio-controlled relay, to an electronic door lock. Also included are installation hints for germanium diodes and a chart of ratings and characteristics of the company's complete line of germanium diode products.

Those who enjoy building and operating electronic gadgets should find this book productive of a great many new ideas.

* * *

"40 USES FOR GERMANIUM DIODES" by Semiconductor Dept. Staff. Published by *Sylvania Electric Products Inc.,* New York. 44 pages. Price 25 cents. Paper bound.

This is the third edition of what has proved to be a popular item with hams, hobbyists, experimenters, and technicians.

The text material is divided into three chapters which cover the construction of receivers and the use of germanium diodes in receiver applications, transmitter and amplifier applications, and instructions for building a wide variety of instruments and gadgets. Many of these demonstrate novel and useful applications for the compact and readily available germanium crystal diodes.

A chart giving the ratings and characteristics of the *Sylvania* line of germanium diodes is appended for ready reference. There are a lot of items covered in this compact volume which should enjoy wide popularity with the experimentally minded hobbyist. —30—

Mac's Service Shop

(Continued from page 74)

putting on a new dial cable can be unless you've restrung one of those old *Majestic* sets with a springy metallic cable whose ends wound into grooves on special receptacles fastened to the tuning shaft. Just recalling that job makes me break into a cold sweat. I'll converge a color set any day in preference to that."

"Did you actually have to neutralize the r.f. stages in a neutrodyne set?"

"And how! What a job that was! In the first place, you were never quite sure a lack of neutralization was making the set oscillate. Dirty wipers on the tuning capacitor, or open plate or cathode bypass capacitors, could produce the same symptom. When the owner admitted he had 'turned those little screws' though, you knew you were in for it. Some of them used an old 26 or 27 tube with a filament pin cut off for the neutralizing dummy. Others argued there was too much variation in grid-to-plate capacity from tube to tube for this to work well and they employed a special adapter socket that allowed each tube, with a cold filament, to serve as a dummy for its own neutralizing circuit. But no matter how you went at it, you usually had to do it over two or three times before you got it right. Again I'll say I'd rather align the i.f. stages of a TV set with a sweep generator and scope than I would neutralize one of those old sets with the equipment we had to use."

"But surely your customers were not so critical as they are now. I imagine if the set worked at all they were satisfied."

"That's what you think! In the first place, a set had to be working quite well to get any reception at all. Remember there was not a powerful station in every little town and hamlet as there is now. Only a few stations, running quite low power by modern standards, were scattered across the country. Most of us lived in ultra-fringe areas for radio reception. My customers here in the Middle West wanted to be able to listen to KDKA, Pittsburgh, in the early evening, then hear Harry Snodgrass playing the piano over WOS in Jefferson City, Missouri, later on, and finally top off the night by picking up West Coast stations along about midnight. Practically everyone was a DX-hound, and if one of my customer's neighbors picked up a station he could not get, he expected me to do something about it.

"What's more, everyone talked about the 'tone' of their set. Actually, all of them were pretty awful by modern standards; but I was constantly being asked to 'put in more bass.' This was right at the time when old-fashioned horn-type loudspeakers were being replaced by dynamic speakers, and most listeners were bass-starved. If a bass drum made the china rattle, the average listener was delighted, even though a violin sounded like a cello."

addition to long, readable 250 degree scales, the instruments are rubber

"Okay, okay!" Barney exclaimed as he threw up his hands in surrender. "I take it all back! You've convinced me that servicing was actually no easier then than it is now. I'm sorry I ever brought the subject up."

"I'm not," Mac confessed. "Now and then, when things go wrong, I'm just as guilty as the next person about wishing we could go back to 'the good old days.' All of us tend to forget the worry, trouble, and headache we suffered long ago and just recall the pleasant and easy times.

"In talking to you, though, I've suddenly realized how good the present times are in service work. Our equipment is accurate, reliable, and versatile. Modern service literature does everything possible to help us pinpoint and correct trouble; moreover this literature is usually in our hands before we need it. Service lectures and meetings and a flood of magazines and books keep us right up to the minute on new developments. Constant increase in the power and number of radio and TV stations assures good signal strength at the great majority of locations. Finally, the public has come to realize that the electronic technician is not a 'tinkerer' but a skilled and highly trained specialist. Back in the 30's he was accorded no such respect; and a lot of us didn't deserve it.

"Today, though, anyone operating a service business has a large sum invested in equipment and service literature. He either has formal training or a wealth of experience behind him, because he cannot use the complicated equipment or understand the literature without it. He is good and he knows it. So does the public." -30-

LATTICE-CRYSTAL FILTER

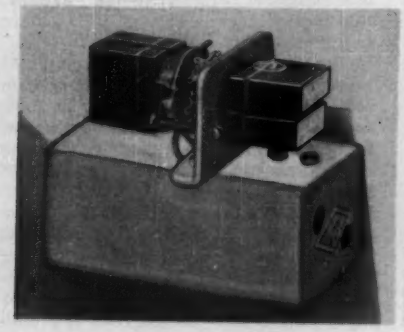
By GENE BRIZENDINE, W4ATE

LATTICE-TYPE crystal filters, popular in single-sideband receivers and transmitters, have in the past involved much wiring and inconvenience in mounting. Pictured is an arrangement which avoids these difficulties.

Two octal sockets are placed back-to-back, and their corresponding lugs are spot-soldered together. This takes care of all the interconnections. The four lattice (bridge) crystals are plugged in, and the "input" and "output" connections complete the job.

Bracket-mounted on the side of an i.f. transformer, the filter allows short leads and presents a neat appearance. -30-

Easy mounting for lattice-crystal filter.



YOU NEED THIS . . .
FREE
GIANT ALL NEW 1958
BA CATALOG
A COMPLETE BUYING GUIDE FOR EVERYTHING IN
RADIO · TV ELECTRONICS
BA 1958
ANNUAL CATALOG 581
SINCE 1927
Guarantee
172 KING-SIZED PAGES
EVERYTHING IN RADIO TV AND ELECTRONICS
100'S OF NEW ITEMS LISTED HERE FOR 1st TIME
21 PAGES OF BARGAINS NOT IN ANY OTHER CATALOG
RUSH COUPON TODAY!
BURSTEIN-APPLEBEE CO. Dept. M,
1012-14 McGee St., Kansas City 6, Mo.
☐ Send Free 1958 B-A Catalog No. 581.
NAME
ADDRESS
CITY STATE

$$

TV SERVICEMEN!
MAKE $50—$100 EXTRA PER WEEK
Install Surgistors on all calls
See your distributor or write:
WUERTH TUBE-SAVER CORP.
9125 Livernois Ave., Detroit 4, Mich.

$$

NEW! ISOTRONIC METHOD
LEARN TV REPAIR *in one short week*
Now, after 5 years research—a *streamlined* training system! Earn up to $150 weekly, in just 7 days. No expensive training, equipment, or long study. Learn to *service* TV sets instead of building them! Most *practical* method yet-developed by leading scientists *with cooperation of major TV mfg.'s!* Send for details and FREE SAMPLE LESSON. Use it on *your* set—repair it!—convince yourself! Write:
ELECTRONIC ENGINEERING CO., Dept. A-76C
1038 So. La Brea, Los Angeles 19, California
FREE! Sample Lesson

EASY TO LEARN CODE

It is easy to learn or increase speed with an Instructograph Code Teacher. Affords the quickest and most practical method yet developed. For beginners or advanced students. Available tapes from beginner's alphabet to typical messages on all subjects. Speed range 5 to 40 WPM. Always ready—no QRM.

ENDORSED BY THOUSANDS!

The Instructograph Code Teacher literally takes the place of an operator-instructor and enables anyone to learn and master code without further assistance. Thousands of successful operators have "acquired the code" with the Instructograph System. Write today for convenient rental and purchase plans.

INSTRUCTOGRAPH COMPANY
4711 SHERIDAN ROAD, CHICAGO 40, ILLINOIS

ered as are detailed physical and operational specifications on available units.

RADIO • TELEVISION • INDUSTRIAL ELECTRONICS

$1.00 HOLIDAY SPECIALS
'TIL DEC. 31st.

JUST A DOLLAR BUYS ANY OF THE FOLLOWING:

RADAR TRANS. (Pictured) 143 to 194 MC. 9 AS Tubes, 5 Ft. Antenna.
Crystal Phone Unit Brush B-6-2 Lightweight • F-1 Carbon Microphone Chest Set • BC-216 Amplifier, 2 Tubes, less tubes • BC-1206 Receiver, 200-400 KC, less tubes, Used • 6 VDC or 12 VDC Motor, 3000 RPM, specify V. • Ounser Transformer in BC-347 Amplifier, less tubes, Used • Whip Antenna, 7 Ft. Telescoping • And: Message Books in Triplicate, 6 for $1.00. (Please note that our minimum order for handling shipment is $5.00.)

TRANSMITTERS:

BC-457—4 to 5.3 MC.—Used.....$ 4.95
BC-458—5.3 to 7 MC.—Used..... 4.95
Navy Type /Comm.—3 to 4 MC.—Used..... 5.95
T-23/ARC-5—100 to 156 MC.—Used..... 14.95
BC-604 FM—20 to 27.9 New: $19.95—Used: 14.95
BC-624 FM—27 to 38.9—New: $19.95—Used: 14.95
BC-375—200-12500 KC 100 Watt, 24 V. Less Tuning Units—Used:..... 29.95
BC-191-200-12, 500 KC 100 Watts, 12V Less Tuning Units—Used:..... 29.95
TA-12—100 Watt, 20-40-80 Meters—Used:.... 29.95
BC-625/PO-SCR-522—100 to 156 MC.—Used: 22.50
BC-230/1430—2500 to 7700 KC.—Used..... 8.95
BC-925 FM—80 to 40 MC. Fixed Tone Freq. U: 29.95
T-39/APO-9—Radar, Approx. 500 MC.—Used: 14.95

RECEIVERS:

BC-683 FM—27 to 38.9 MC.....Used: $34.95
BC-603 FM—20 to 27.9 MC.....Used: 14.95
BC-357 Beacon—75 MC.....New: 5.95
CRW-2/HF—53 to 88 MC. Fixed Freq..New: 7.95
R-24/ARC-5—500 to 1500 KC.....New: 24.95
BC-1206—200 to 400 MC. Used: $5.95—New: 9.95
RA-10DA—150 to 1100 & 2 to 18 MC...Used: 39.95
RA-10FA—150 to 400 & 2 to 18 MC...Used: 29.95
BC-624/PO-SCR-522—VDO to 156 MC...Used: 19.95
BC-229-429—200 to 400 & 2500 to 7700 KC.U: 5.95

RECEIVER—TRANSMITTERS:

RT-19/ARC-4—144 to 148 MC. Less tubes.....Used: $12.95
BC-650-FM—27 to 38.9 MC.....Used: 19.95
BC-500-FM—20 to 28 MC.....New: 59.50
BC-745-AM—2 to 3 MC.....Used: 14.95
SCR-522-AM—100 to 156 MC.....Used: 34.95

NEW CIRCULAR—FREE!
Describes all these advertised items in detail. Send for your FREE Copy today.

6 VDC DYNAMOTORS:

640 VDC—260 MA.—Reconditioned by G.E. $12.95
420 VDC—260 MA.—Reconditioned by G.E. 9.95

12 VDC DYNAMOTORS:

		NEW:	USED:
825 VDC—225 MA....	DM-35		$11.95
540 VDC—450 MA....	DA-12	$14.95	11.95
225 VDC—100 MA....	D-402	5.95	3.95
220 VDC—80 MA.....	DM-34	2.95	
230 VDC—90 MA.....	PE-133		4.95
150 VDC—100 MA....	DM-310X		2.95
250 VDC—60 MA.....	DM-32-12V		4.95
250 VDC—50 MA.....	DM-25	4.95	2.95
425 VDC—165 MA.....	WE-877	11.95	8.95

SELSYN TRANS. & INDICATOR:

Ideal as Radio Beam position indicator for Ham, Television, or Commercial use. Complete with
I-82 Five inch Indicator, Autosyn Trans., 12 Volt 60 cycle transformer, & wiring instructions.
Price—Complete—Checked—Used $9.95
Price—I-82 Indicator only..... 3.95
Price—MC-217 Autosyn only..... 3.95

WHIP ANTENNAS:

AN-45—Telescoping 96" $1.95
AN-131—Throw-Out type—120" 1.95
AN-109—Whip, Rigid Mount—5 Ft..... 1.50
AN-117—Whip—No mounting—6 Ft..... 1.50

TELEPHONE & REMOTE CONTROL UNITS:

EE-8 Field Telephones—Used, Checked.....$14.95
RM-52 Remote Control Unit: Used: $1.95—New: 3.95
RM-53 Remote Control Unit: Used: $2.95—New: 4.95
RM-12 Remote Control Unit: U: $14.95—New: 19.95
RM-13 Remote Control Unit: U: $18.95—New: 23.95
RM-29 Remote Control Unit: Used: $4.95—New: 6.95
BD-72 Switchboard—12 Line—Used, Checked.. 39.50
RM-21 Remote Control for BC-609..... 4.95
RC-298 Interphone Kit—Complete..... 9.95

Address Dept. RN • $5.00 Order Minimum, & 25% Deposit on C.O.D.'s • Prices are F.O.B. Lima, Ohio

FAIR RADIO
132 So. MAIN ST. • LIMA, OHIO

ALLIED'S 1958 CATALOGUE

Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill. has announced publication of its 1958 general catalogue of electronic parts and equipment, including a complete line of high-fidelity components.

The new 404-page catalogue (192 pages in roto and 4-color covers) lists over 27,000 items. Described and pictured is the new line of 52 "Knight-Kit" electronics kits. The line includes test instruments, hi-fi gear, ham and experimental equipment.

Industrial equipment, components, assembled high-fidelity equipment, stereo gear, TV tubes, p.a. systems, technical books, and a complete line of equipment for the radio amateur are pictured and described.

Copies of the new catalogue are available without charge. Write the company direct.

CENTRALAB SWITCHES

Centralab, a division of *Globe-Union Inc.,* 900 E. Keefe Ave., Milwaukee, Wis. is now offering copies of a new 35-page manufacturer's switch catalogue which contains complete specifications on rotary, slide, and lever switches.

The new publication provides complete specifications on the line which will handle power from a kilowatt to a microwatt. Manufacturers wishing a copy of this catalogue should address their requests to Gerry Klein in care of the company.

SOLDERING SEMICONDUCTORS

Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn 22, N. Y. is making available a handy reference chart for semiconductor soldering applications as a service to the electronic and allied industries.

The reference chart offers phase diagrams for the more popular of the company's soldering alloys used in semiconductors. In addition, a list of high-purity elements is included, indicating the purity of each element that is available.

Copies of the chart will be supplied without charge on request.

LONG-SCALE METERS

A bulletin covering the group of long-scale panel meters for specialty applications has been issued by *Weston Electrical Instrument Corporation,* Newark 12, N. J.

The publication lists instruments which are available in sizes from 2½" to 5½" for a wide range of current and voltage indications as well as tachometry and temperature applications. In addition to long, readable 250 degree scales, the instruments are rubber mounted for shock resistance and embody spring-backed jewel construction.

Copies of this new bulletin are available from the manufacturer at no charge.

CLOSED-CIRCUIT TV

General Precision Laboratory Inc., 63 Bedford Rd., Pleasantville, N. Y. had issued a four-page descriptive catalogue sheet covering its Model PD-500 closed-circuit television camera.

The publication lists the outstanding features of this equipment and fully describes the design characteristics of the camera, built-in power supply, and control accessories for complete remote operations. Detailed specifications and dimensions are also provided.

TRANSISTRON PUBLICATION

Transitron Electronic Corporation of Wakefield, Mass. has issued a six-page booklet covering its line of silicon transistors, diodes, rectifiers, and regulators as well as germanium diodes and transistors.

Included in this concise publication is a listing of the special features of each type, type and size data, and complete specifications as to current, resistance, and voltage ranges.

For a free copy of this publication, please write the manufacturer direct.

SUPREME SERVICE BOOKS

Supreme Publications, 1760 Balsam Road, Highland Park, Ill. is now offering copies of a 4-page circular which lists and describes in some detail a number of its most recent servicing manuals.

In addition to listing current publications, the brochure also carries information on earlier volumes still available and provides ordering instructions. Copies of the brochure are available upon request and without charge.

TRANSISTOR DATA

General Transistor Corp., 91-27 138th Place, Jamaica 35, N. Y. is now offering copies of its Bulletin G-120 which describes a complete line of *p-n-p* and *n-p-n* transistors for radio, r.f., and i.f. applications.

The new publication also contains valuable information on 4-, 6-, and 7-transistor radio kits together with related schematic diagrams. Copies of this bulletin are available without charge.

TANTALUM FOIL CAPACITORS

Ohmite Manufacturing Company, 3655 Howard St., Skokie, Ill. has announced publication of a single-sheet, two-color bulletin which covers the unique characteristics of its line of tantalum foil capacitors.

The publication points out that these components have exceptional stability, shelf life, and greater capacitance per unit volume. Applications and limitations of the polar and non-polar types of tantalum foil electrolytics are cov-

ered as are detailed physical and operational specifications on available units.

When writing, please specify Bulletin 152.

NEWARK'S NEW CATALOGUE

Newark Electric Company, 223 W. Madison St., Chicago 6, Ill. is now distributing copies of its 360-page catalogue, No. 68.

All of the items handled by the company for the industrial, hi-fi, servicing, amateur, and experimental fields are illustrated and described in this comprehensive publication.

Kits as well as assembled equipment are featured. The products of several hundred manufacturers are represented. Both product and manufacturers' indexes are included to facilitate the location of any specific item that is included.

The company will be glad to send a copy to those writing either the Chicago office or the West Coast Division at 4736 W. Century Blvd., Inglewood, Calif.

CAREER TRAINING DATA

Cleveland Institute of Radio Electronics, 4900 Euclid Ave., Cleveland 3, Ohio has issued a 24-page brochure and course outline which contains complete and up-to-date information on electronic industry employment requirements and opportunities.

The brochure emphasizes that true technical competence in electronics is necessary to guarantee success in such a rapidly changing field.

The publication tabulates fields in which technicians are in demand and lists job titles and duties. The balance of the book outlines the Institute's training program and a brief resumé of the content of the various courses is given.

Copies of this brochure are available without charge on request.

LAFAYETTE CATALOGUE

Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y. has issued a new 180-page catalogue which it is distributing without charge to interested persons.

The parts and equipment listed cover the industrial, service, and hi-fi fields as well as non-electronic products and books for the hobbyist.

Special emphasis has been placed on components for transistor circuit construction and the experimenter will find a full line of subminiaturized parts listed.

Kits and assembled units marketed under the company's own brand-name as well as the kits and instruments of other manufacturers are conspicuously featured.

Write the company direct for a free copy of this new publication. Please specify Catalogue 305.

CONSTANT VOLTAGE TRANSFORMERS

Sola Electric Co., 4633 W. 16th St., Chicago 50, Ill. is now offering an illustrated 4-page catalogue sheet which describes its line of constant voltage

RADIO • TELEVISION • INDUSTRIAL ELECTRONICS

THIS professional TRAINING IS THE KIND THAT Really Pays Off!

. . . and it costs only a fraction of what you might expect to pay!

FIX ANY RADIO OR TV SET EVER MADE...easier...better...faster

Backed by the how-to-do-it methods so clearly explained in this one big 822-page book, you'll be prepared for fast, accurate service on any radio or television receiver ever made.

Radio & Television TROUBLESHOOTING AND REPAIR by Ghirardi & Johnson is far and away the world's most modern, easily understood guide. Step by step, it takes you through each service procedure . . . from locating troubles with less testing to repairing them promptly by fully-approved professional methods . . . the kind that enable you to handle tough jobs as slick as you now do the easy ones.

Best of all, the cost is only $7.50 (or see money-saving combination offer in coupon).

COMPLETE SERVICE TRAINING

For beginners, this giant book is a complete training course. For experienced servicemen it is the ideal way to develop better methods and to find fast answers to tough jobs.

Here are just a few of the subjects covered: Components and Their Troubles; Basic Troubleshooting Methods; "Static" and "Dynamic" Testing; Practical Troubleshooting Tips and Ideas; AC/DC, 3-way Portable and Battery Set Troubleshooting Problems; Servicing Communications Receivers; a Complete Guide to Television Service; AM, FM, and TV Realignment Made Easy; Resistor, Capacitor, Inductor and Transformer Problems; Servicing Tuning, Selector and Switching Mechanisms; Loudspeakers; Servicing Recorders and Record-playing Equipment . . . and dozens more! 417 illustrations. Read TROUBLESHOOTING AND REPAIR for 10 days AT OUR RISK!

SAVE $1.25

Make your training library complete! Get both big books for only $13.00. (You save $1.25)

LEARN BASIC CIRCUITS FULLY...and watch service "headaches" disappear

It's amazing how much easier and faster you can repair radios, television sets and even industrial electronic equipment when you know all about circuits and what makes each one "tick."

You locate troubles in a jiffy because you know what to look for and where to look.

You make repairs lots faster, better and more profitably!

Actually, there are only a comparatively few BASIC circuits in modern equipment. Radio & Television RECEIVER CIRCUITRY AND OPERATION by Ghirardi and Johnson gives you a complete understanding of these as well as their variations. It teaches you to recognize them . . . to understand their peculiarities and likely "troublespots" . . . and shows how to eliminate useless testing and guesswork in making repairs.

A COMPLETE GUIDE TO RADIO-TV CIRCUITS

Throughout, this 669-page book with its 417 clear illustrations gives you the kind of above-average professional training that fits you for the better, big pay jobs in either servicing or general electronics.

Covers all circuits in modern TV and radio receivers, amplifiers, phono-pickups, record players, etc.

Price only $6.75 . . . or see money-saving offer in coupon. Examine it 10 days at our risk!

The books that explain SERVICE PROCEDURES so you can really understand them!

Almost 1300 pages and over 800 pictures and diagrams in these two new books explain things so clearly it's next to impossible for you to go wrong.

FREE EXAMINATION...easy terms

Dept. RN-127, RINEHART & CO., INC.
232 Madison Ave., New York 16, N. Y.

Send books indicated for FREE EXAMINATION. In 10 days, I will either remit price indicated plus postage or return books postpaid and owe you nothing.

☐ Radio & TV TROUBLESHOOTING AND REPAIR (Price $7.50)
☐ Radio & TV CIRCUITRY AND OPERATION (Price $6.75)
☐ COMBINATION OFFER . . . Both books only $13.00 (Regular price separately $14.25 . . . you save $1.25)

(Combination offer is payable at rate of $4 (plus postage) after 10 days if you decide to keep books, and $3 a month thereafter until $13 has been paid.)

Name.....
Address.....
City, Zone, State.....

OUTSIDE U.S.A. . . . $8.00 for TROUBLESHOOTING & REPAIR; $7.25 for CIRCUITRY & OPERATION; $14.00 for both books; Cash with order, but money refunded if you return books in 10 days.

Magnetic Amplifiers
(*Continued from page* 71)

QUALITY LEADER...price leader too!

You'll enjoy . . .
THE CHALLENGING NEW THEME OF THIS YEAR'S
PHOTOGRAPHY ANNUAL!

The 1958 edition of the PHOTOGRAPHY ANNUAL is the brightest and most imaginative ever published. Its theme, its contributors, its 250 pages of striking photographs are certain to delight you!

"WHAT IS A CAMERA?"
is the exciting theme.

In answer to that question, the Editors of POPULAR PHOTOGRAPHY have compiled "an illustrated definition of photography"—including a selection of the most entertaining and original pictures you've ever seen.

The wonderful world of photography will be yours to enjoy through the lens of:

The Roving Camera
The Playful Camera
The Workaday Camera
The Romantic Camera
The Realistic Camera
The Intimate Camera of Harold Feinstein
The Nighttime Camera
The Story-Telling Camera
The Portrait Camera
The Nature Camera
The Glamour Camera of Don Ornitz
The Casual Camera
The Color Camera
The Action Camera
The Imaginative Camera
The Adventurous Camera

BEST OF ALL—you'll profit from a special section on the most important camera of all—*Your Camera*. A helpful guide to learning from the photo masterpieces of others!

BUY YOUR COPY OF
THE 1958
PHOTOGRAPHY ANNUAL
on sale now—only $1.00.

transformers for 6.3 volt filament supply applications.

Information in the folder includes the operation of such units and gives electrical and mechanical data and prices of five stock transformers. These units provide voltage regulation within ± 1% with line voltage variations as great as ± 15%. They supply 6.3 volts up to 25 amps.

Circular CVF-269 will be supplied without charge on written request.

NEW IRC PUBLICATIONS

International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa. has issued two new catalogue data bulletins of interest to the industry.

The first, LT-2, provides comprehensive data on size and thickness, properties, current-carrying capacities, foil, copper finish, post-etching suggestions, handling recommendations, etc. on its new "Fluoroply-F" laminate for printed circuit applications.

The second publication (A-4a) provides complete information on the firm's line of "Type Q" composition controls. It lists construction, materials, identification, dimensions, shafts, bushings, hardware, switches, torque, resistance tapers, etc. as well as providing detailed graphs and drawings.

Either or both bulletins may be obtained by writing the manufacturer direct. -30-

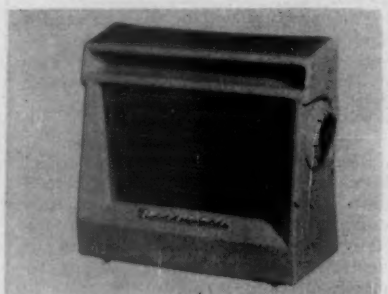
SIX-TRANSISTOR RECEIVER KIT

AN ALL-TRANSISTOR portable receiver which features six transistors and two diodes has recently been announced by Heath Company. This standard-broadcast set covers from 538 to 1680 kc. and is powered by six standard flashlight batteries.

The design features a conventional superheterodyne circuit with a 455 kc. i.f. strip. The output stages employ two 2N185 transistors in push-pull class B operation. A 15,000 ohm resistor is connected between the collector and base of each of these output transistors to form feedback loops which effectively reduce distortion.

Almost all transistor receivers produced to date are of extremely compact construction. This particular receiver differs in that the over-all size is a relatively large 9" x 8" x 3¾". The use of a 4" x 6" speaker in this set precludes the miniaturization of the receiver in this case.

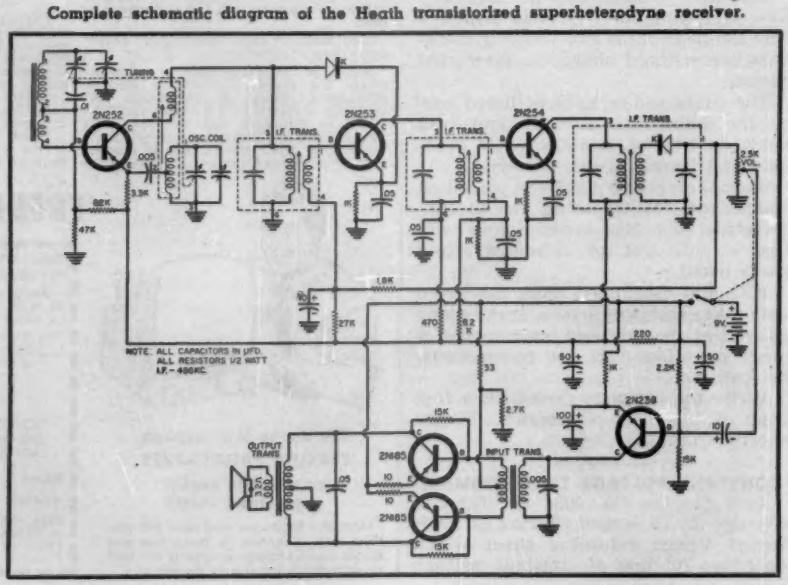
The performance of this unit is exceptionally good. The sensitivity and power output are almost equal to those obtainable with a conventional five-tube a.c.-d.c. type receiver. It is entirely suitable as a household receiver where the user wishes to avoid the necessity of plugging into a power line. However, its greatest usefulness is that of a portable receiver where 117-volt service is not available. Since standard "D" flashlight cells are used, replacement cost is negligible. Battery life is estimated to be from 500 to 1000 hours.



The Heath six-transistor radio receiver, (shown assembled) unlike many other sets of the type, is not subminiaturized.

This receiver, available in kit form, does not present any unusual assembly difficulties. Its relatively large size eliminates any problems which might be traceable to miniaturization. -30-

Complete schematic diagram of the Heath transistorized superheterodyne receiver.



PASS FCC
Commercial & Amateur

R. F. Power Monitor

(*Continued from page 57*)

When working with transistor r.f. oscillators of very low power, it is permissible to bring the loop very close to the transistor oscillator tank

Magnetic Amplifiers

(*Continued from page 71*)

back is added to a magnetic amplifier through a series resistor from the output to the input. The diode rectifier is oriented for in-phase output. The discriminator has two possible stable states, either high- or low-current output. When the input current is above a certain value the output will be saturated. When the input current is below another certain value the output current is low and non-saturated. The circuit "hysteresis" is the difference between these two input current values. The magnitude of the hysteresis depends on the size of the feedback resistance. When the value of input current is within the range of these values the output state depends on whether the input was previously above or below the "hysteresis" range. The change of state is caused by regeneration. In the circuit shown the hysteresis is 130 microamperes.

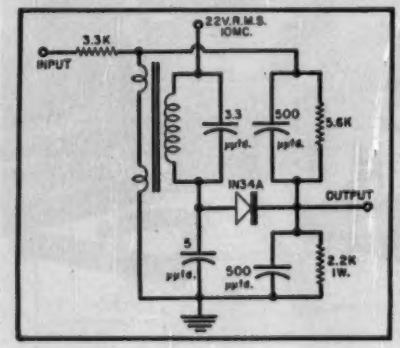
The current discriminator may also be used as a pulse gate. A d.c. bias fixes the static level of the control current without input pulses. If the d.c. level is high the gate is "open," because input pulses can reach the region of partial saturation to produce output pulses. If the d.c. level is low the gate is "closed."

"Ferristor" reactors are very versatile. They can be used in many circuits including oscillators, multivibrators, discriminators, balanced or differential amplifiers, coincidence gates, ring counters, binary counters, stepping registers, and many others.

These reactors are almost completely unaffected by shock, vibration, temperature, humidity, altitude, time, and the other things affecting vacuum tubes. They are reactive rather than dissipative devices so they generate little heat and there is practically no power waste. For these reasons they should last almost indefinitely.

The invention of the audion displaced the original magnetic amplifier from favor. But now its modern descendant—the "Ferristor" reactor—with its greater inherent ruggedness may replace the relatively short-lived vacuum tube for certain applications requiring good reliability. -30-

Fig. 5. Circuit of current discriminator.



QUALITY LEADER...price leader too!

Your everyday instrument . . . the *most used* instrument . . . should be the finest money can buy. That means the WESTON Model 980 VOM . . . available to-day at lowest price ever. It's extremely compact, with the ruggedness and stamina to withstand daily abuse. And you can be sure of each reading, for it has all the accuracy for which Weston instruments are world famous. Provides 28 functional ranges, simplified by a single dial. Use it for TV and radio servicing as well as industrial measurement needs. Available through your distributor; or, descriptive literature by writing . . . WESTON Electrical Instrument Corp., 617 Frelinghuysen Avenue, Newark 12, N. J.

WESTON
TEST EQUIPMENT
The Quality Line
A DAYSTROM UNIT

ONLY RAD-TEL CAN SAVE YOU SO MUCH ON DYNAMIC SPEAKERS

PHONO MOTORS
all 60 cycle 105/117v

No.	Model	RPM	List
338	M4	78	15.00
341	M15	33	16.00

Your Choice **98¢** each

Rad Tel TUBE CO.

No C.O.D.'s please. Allow for postage. Subject to prior sale.

Not Affil. With Any Other Tube Mail Order Co.

Rad-Tel	Dia.	Field	V.C.	Each	Lots of 3
345	5"	600	3.2	$ .79	$ .69
329	5"	1000	3.2	.79	.69
330	5"	1300	3.2	.79	.69
348	5"	3500	3.2	.79	.69
331	5x7"	600	3.2	.89	.79
346	6"	1700	3.0	.98	.89
349	6x9"	4	3.2	1.09	.99
343	6x9"	1100	5.3	1.09	.99
344	7"	1075	3.0	.99	.89
342	10"	60	3.2	.99	.89
347	12"	500	3.2	1.99	1.69
333	12"	700	10.0	1.99	1.69
332	12"	800	3.2	1.99	1.69
334	14"	1100	5.1	2.05	1.90

55 Chambers St., Newark 5, N. J. Send for PARTS and TUBE CATALOG

PASS FCC
Commercial & Amateur
THEORY & CODE
LICENSE EXAMS
EASILY!

Learn Code or Theory from AMECO
Easy-to-Understand Books or
Unbreakable 45 or 78 Code Records

No. 8-01—THE COMMERCIAL RADIO OPERATOR'S QUESTION AND ANSWER LICENSE GUIDE —Elements 1 and 2. This book contains the questions and clear simplified answers for elements 1 and 2. In addition it contains SAMPLE FCC-TYPE PRACTICE EXAMS USING MULTIPLE CHOICE QUESTIONS. (Elements 1 and 2 are required for all FCC commercial exams.) Only 75c

No. 9-01—THE COMMERCIAL RADIO OPERATOR'S QUESTION AND ANSWER LICENSE GUIDE —Element 3. Contains questions and answers and SAMPLE FCC-TYPE PRACTICE EXAM for element 3. Complete preparation for 2d class Radio Telephone license. Only $1.75

No. 102-01—COMPLETE AMATEUR RADIO THEORY COURSE. A complete, simplified home study theory course in radio covering the Novice, Technician, Conditional and General classes—all under one cover—with nearly four hundred typical FCC type questions to prepare you for license exam. No technical background required. You also get, FREE, a guide to setting up your own Ham station. All for the amazing low, low price of $3.95

No. 100—NOVICE CODE COURSE. You get and keep 10 recordings (alphabet through 8 W.P.M.). Includes typical FCC type code exams. Free instruction book on learning how to send and receive code the simplest, fastest way; plus charts to check your receiving accuracy; plus an album; all for the low price of only:
45 r.p.m.... $6.95 78 r.p.m.... $7.95

No. 101—SENIOR CODE COURSE. You get and keep everything given in the Novice Course except that you get 22 recordings (alphabet through 18 W.P.M.), plus typical FCC type code exams for General class and 2nd class commercial telegraph licenses. All this for only.
45 r.p.m.... $11.95 78 r.p.m.... $12.95

If your Radio Supplier does not carry AMECO Books, send your order direct to Dept. R12.

AMERICAN ELECTRONICS CO.
1203 Bryant Ave., New York 59, N.Y.

ARE
YOU
AWARE

That the classified pages of RADIO & TV NEWS afford readers and advertisers alike an opportunity to buy, sell and trade among the world's largest electronics audience.

For further details and rates write to:

MARTIN LINCOLN
CLASSIFIED ADVERTISING
MANAGER

Ziff-Davis Publishing Company
366 Madison Avenue
New York 17, N. Y.

R. F. Power Monitor

(*Continued from page 57*)

input impedance of the first amplifier stage, V_1, the number of turns in the pickup loop will, in any case, be considerably greater than is normally used when a loop is directly connected to a lamp.

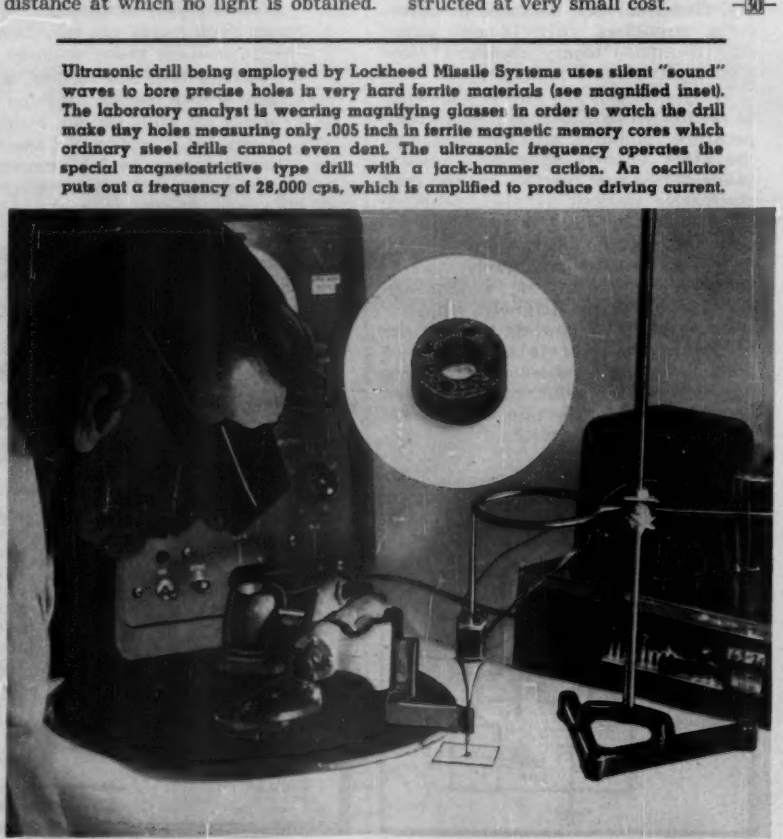
To test the completed instrument, remove the pickup loop from the circuit. Connect a 1000-ohm resistor in series with a flashlight cell. Turn on switch S_1. The voltage from the flashlight cell and 1000-ohm resistor should be applied between the emitter of transistor V_1 and the free end of diode CR_1. Be certain that the positive pole of the test cell is closest to diode CR_1 and the negative pole of the test cell is closest to the emitter of transistor V_1. The lamp should light brightly in this case.

If operation is not obtained by means of this test, check the polarity of batteries B_1 and B_2. A mistake easily made in complementary transistor amplifiers is to bias both transistors as though they were of the same variety. If the lamp burns with no input to V_1 it is indicative of excessive residual collector current in V_1. Such a transistor cannot be used. Most *G-E* ZJ6 and 2N78 transistors are completely satisfactory in this particular respect.

When using the power monitor, always approach the r.f. source from a distance at which no light is obtained. When working with transistor r.f. oscillators of very low power, it is permissible to bring the loop very close to the transistor oscillator tank coil. The coupling under such conditions is still quite loose due to the high impedance of the V_1 input. Consequently, such a measurement technique will produce very little disturbance in the oscillator circuit. *When the sensitive r.f. power monitor is not in use, be certain that switch S_1 is in its "Off" position.*

The several hours spent constructing this interesting device will prove rewarding. Beside its intended applications, slight modifications can transform the circuit into other useful devices. A tuned circuit may be substituted for the loop, thereby producing a wavemeter of high accuracy by virtue of the negligible loading exerted upon the tank circuit under measurement. The circuit is useful for light-beam modulation experiments. A photographer suggested an adaptation as a remote slave light source for photographing small animals. The fact that no wire would be needed between the camera and the slave light source is an asset for candid shots. (Either 27 mc. or 460 mc. might be used.) Various burglar alarm set-ups are possible. It is not often that a combination of so few elements harbors so many potentialities. To top this, the intended function of this device, as a sensitive monitor of the r.f. power, is a worthwhile improvement in instrumentation which may be easily constructed at very small cost. —30—

Ultrasonic drill being employed by Lockheed Missile Systems uses silent "sound" waves to bore precise holes in very hard ferrite materials (see magnified inset). The laboratory analyst is wearing magnifying glasses in order to watch the drill make tiny holes measuring only .005 inch in ferrite magnetic memory cores which ordinary steel drills cannot even dent. The ultrasonic frequency operates the special magnetostrictive type drill with a jack-hammer action. An oscillator puts out a frequency of 28,000 cps, which is amplified to produce driving current.



FANTABULOUS

Servicing 3-Way Radios

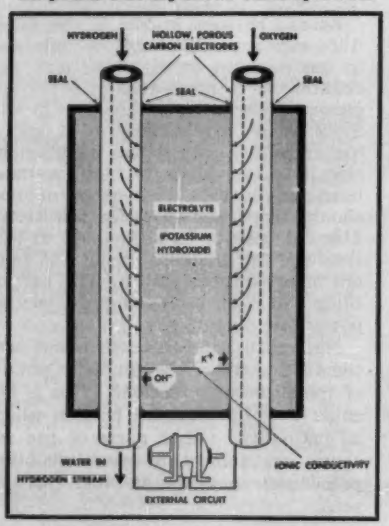
Dr. K. Kordesch, developer of fuel cell, is holding one of cells described here.

Fuel Cell Produces Electricity From Gases

First practical conversion of chemical energy of gases.

DIRECT conversion of the chemical energy of gases into electricity has been accomplished with the development by *National Carbon Co.* of the first practical fuel cell. A single fuel cell unit consists of 9 hollow, porous carbon electrodes grouped in a round plastic housing. A carbon header on each end channels hydrogen and oxygen gases into the proper electrodes, and electrical connections conduct away the power. The cell is filled with a solution of potassium hydroxide, which serves as the electrolyte. The voltage produced across the electrodes of the new fuel cell is about 1 volt, although fairly high currents may be delivered. —30—

Simplified drawing shows basic operation.



IF THIS MAN IS ON YOUR CHRISTMAS LIST—

A subscription to RADIO & TV NEWS will make a perfect gift for him, and every other man with a stake in electronics.

If he makes his living in electronics or is an advanced hobbyist who loves Hi-Fi, Radio, TV, Audio, R/C, ham radio and communications, he'll be delighted to get RADIO & TV NEWS as a gift. For RADIO & TV NEWS offers the best technical coverage in the field. It provides men in electronics with tips and techniques on repairing, installing and maintaining radio and TV sets and circuits, latest Hi-Fi developments, newest ham techniques, fresh audio ideas, test equipment, and current industry news. There is no more thoughtful Christmas gift, or flattering one, than a subscription to RADIO & TV NEWS, the first and most authoritative magazine in the field. Each of your gift subscriptions will be announced by an attractive card, inscribed with your name. What's more, you can enter or extend your own subscription to RADIO & TV NEWS at these special Christmas gift subscription rates, too!

First 1-year gift subscription $4
Each additional 1-year gift subscription $3

Fill in and return the postage-paid envelope facing page 179 for your own and gift subscriptions. List additional gift orders on an extra sheet of paper.

WRAP UP YOUR CHRISTMAS GIVING NOW! DO IT EASILY, AND APPROPRIATELY, WITH *RADIO & TV NEWS*

ZIFF-DAVIS, INC. PUBLISHERS

RADIO & TV NEWS • 64 EAST LAKE ST. • CHICAGO 1, ILLINOIS

Marker Generator

(Continued from page 69)

FANTABULOUS

IMPORTED BRITISH FM TUNER FOR UNEXCELLED RECEPTION

DYNAMIC "V" BEAM TUNING INDICATOR

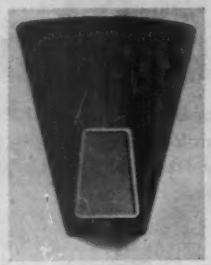
Compare Our Specifications With Other Tuners Costing Up To Twice Our Price. Reception to 150 Miles. Factory Wired and Tested.

Sensitivity: .9 microvolt for 20 db quieting; 1.8 μv for 30 db. Frequency response 20-20,000 cps ± ½ db. Inputs: 300 OHM balanced. IF band width 200 KC. Stability: only 20 KC. Stable after 1 minute. 6 Mullard high gain, low noise tubes; 10 tuned circuits. Front end completely shielded in a solid casting. Better than FCC requirements. Frequency range: 88 to 108 MC with 0-100 logging scale. Grounded grid RF amplifier & reflex converter completely sealed—eliminates microphonics. Output level control: styroflex & ceramic condensers used throughout with carbon deposited resistors. "V" beam tuning indicator. Illuminated, unbreakable precision-calibrated dial assembly. Phono input connection: set is off when phono is on. 1 year warranty on all part defects. Tubes carry standard 90 day. 110/125V AC; 50-60 cycles; 30 watts. 10½" wide; 5¾" high; 6½" deep. 12 lbs.

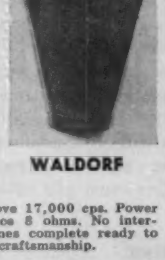
AIREX'S LOW INTRODUCTORY PRICE **$49.95**

Wood cabinet (Mahogany or Blonde) **$8.95**

TSL Concert Soundcorner



CARLTON



WALDORF

Now you can add a true Hi-Fidelity 2-way speaker system to your present amplifier at new low cost without sacrificing floor space. These units are ideal for use in Stereo systems where 2 separate speakers are desired on the same wall. Excellent for extending your present loudspeaker system, or can be used to replace your present speaker in your radio or phonograph. Hangs on the corner of the wall and uses the sides of the wall as part of the enclosure. Uses Lorenz LP215 bass speaker, Lorenz LPH65 tweeter unit and associated crossover network. Units are mounted on a beautifully finished multiple ply bonded hardwood in mirror polished walnut. Carlton model has gold frame with neutral color grill cloth to blend in with any wall color and is washable. Every unit is fully guaranteed to give you the finest in listening pleasure. Specifications: Size: 27" high. 24" wide at top and 11½" at the bottom. Frequency range 35 to above 17,000 cps. Power rating 15 watts, Impedance 8 ohms. No intermodulation distortion. Comes complete ready to use. A product of British craftsmanship.

AIREX'S LOW INTRODUCTORY PRICE **$44.50** either model

If you are building a Hi-Fi System, **SEND US YOUR LIST OF COMPONENTS.** We will give you a **PACKAGE QUOTATION ON THEM.**

All merchandise is brand new, factory fresh & guaranteed. Mail & phone orders filled on receipt of certified Check or MO of 20% of items as a deposit. Balance C.O.D., F.O.B. N. Y. Prices & specifications subject to change without notice.

AIREX RADIO CORP.

64-R Cortlandt St., N. Y. 7, CO 7-2137

Servicing 3-Way Radios

(*Continued from page 46*)

overload the other filaments and, besides, the readings will be way off.

Filament Current Resistors

In most receivers of this type, it will be found that there are resistors connected between some of the filaments and ground or across some of the filaments. Such connections are illustrated in Fig. 2. The reason for this practice is that, since there is no separate cathode in a battery-type tube, the plate current must enter each tube through its filament lead. In so doing, for some tubes, it must pass through the filaments of other tubes.

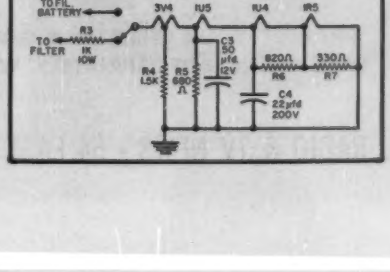
For example, in Fig. 3, the broken-line arrows indicate the flow of plate current; the solid-line arrows indicate the flow of filament current. Note that the filament of V_3 has to carry the plate currents of V_1 and V_2, as well as the filament current. In actual receivers, a string of four tubes is usually used and pentodes add screen-grid current to the load. Overload of the filaments due to the extra plate and screen currents would occur if equalizing resistors were not used. Fig. 2 shows the equalizing resistors R_4, R_5, R_6, and R_7. These resistors shunt parts of the filament circuit and carry the extra plate and screen currents.

If one of these equalizing resistors should burn out or otherwise open up, it might take a filament along with it because of the overload caused by plate current. If this does happen, and a new tube is substituted for the burned-out one without prior attention to the resistor, the new tube may also burn out. It is thus very important, before any tubes are installed in one of these receivers, to check the whole filament circuit to make sure all components match the schematic.

Filament Filter Capacitors

An even more likely cause of tube burn-out in replacement is an open condition in protective resistor R_8, and consequent release of the charge from filter capacitor C_8 into some of the filaments. This capacitor is used to filter the hum out of the directly heated cathodes, so that such hum cannot modulate the plate currents of the tubes during a.c. operation. It ordinarily has a value from 50 to 100 μfd., and may be connected at any position along the filament string. Notice in Fig. 2 that, if R_8 were to open up, the capacitor would charge to a high

Fig. 2. Resistor network is needed in the filament circuit of a 3-way radio.



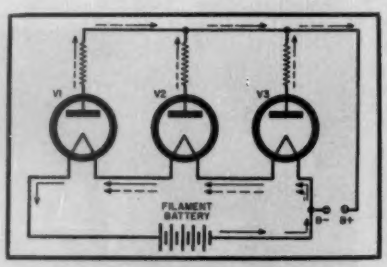


Fig. 3. The path of plate current through the filaments of a 3-way radio.

proportion of the full voltage from the power supply, if one of the filaments is also open. Even if R_8 is not completely open, but just high in value, excessive voltage can still appear across this capacitor. The 3V4 filament is particularly vulnerable, since it would carry full charging current into the capacitor. If we are not aware of this possibility, and substitute a new tube for the one burned out, the charge from the capacitor is released through the filament string and the new tube, or one of the others, burns out. Note that this can happen *with the receiver turned off!* The capacitor can hold its charge for some time.

Thus, it is best to make sure this capacitor is discharged and then to check the protective resistor R_8 before any substitutions of new tubes are made. Discharge the capacitor by shorting right across its terminals with a screwdriver to keep the charge from passing through any other components. Even though it seems like a lot of trouble at the time, it pays to check the whole filament circuit each time a burned-out tube is replaced. After a new tube has burned out due to an open resistor, we really appreciate why this is an important precaution!

Some technicians make it a rule to trace out the filament circuit before making any repairs or replacing any components. It's very helpful to know where each shunt resistor and bypass capacitor is connected in the circuit before servicing operations start.

Other Bypass Capacitors

As can be seen in Fig. 2, the large filter capacitor C_8 is not the only one in the filament string. You may encounter one or more mica or paper bypasses on the order of 0.05 to 0.25 μfd. Since these are usually of a much higher voltage rating than the filament circuit, or even than the "B+" voltage, burn-out is rare. However, if one should short, it can cause full series filament voltage to be applied to less than the full filament string and take one or more tubes with it. This sort of thing can happen on either battery or power-line operation.

Not much has been said about sections other than the filament circuit of the three-way receiver. This is because it is the filament portion which is distinctive. Other parts of the receiver are subject to troubleshooting procedures applicable in other types of sets. —30—

RADIO ELECTRONIC

ohms in the original circuit. They are changed to 3300 ohms each. Resistor

Marker Generator

(*Continued from page* 69)

erator should now be checked by moving S_2 to the 1000 kc. position. The change in beat should be very small although a small difference will not affect the accuracy of the main markers, *i. e.*, the harmonics of 100 kc. The crystal marker generator will now provide usable harmonics either every 100 kc. or every 1000 kc. throughout the amateur bands.

As an example of the use of the instrument in adjusting the frequency of a v.f.o. precisely at the edge of the band, consider the following: a transmitter is to operate on A1 emission (c.w. telegraphy) a few kc. inside the lower end of the 80 meter band (3500-4000 kc.), say, on a frequency of 3505 kc. Using the 1000 kc. output of the marker generator, its fourth harmonic is identified on the receiver and this spot is calibrated as 4000 kc. The 100 kc. output is now turned on and the receiver carefully tuned lower in frequency counting 100 kc. harmonics at 3900, 3800, 3700, 3600, and 3500. The last marks the lower edge of the band. Since it is expected that the receiver calibration is at least accurate over 100 kc.—and it would be a sad one, indeed, if it were not!—moving up 1/20 of the distance between the 3500 kc. marker and the 3600 kc. marker would place the receiver exactly on 3505 kc. The output of the v.f.o. is now adjusted so that it zero-beats on this receiver setting and the transmitter is ready to go. —50—

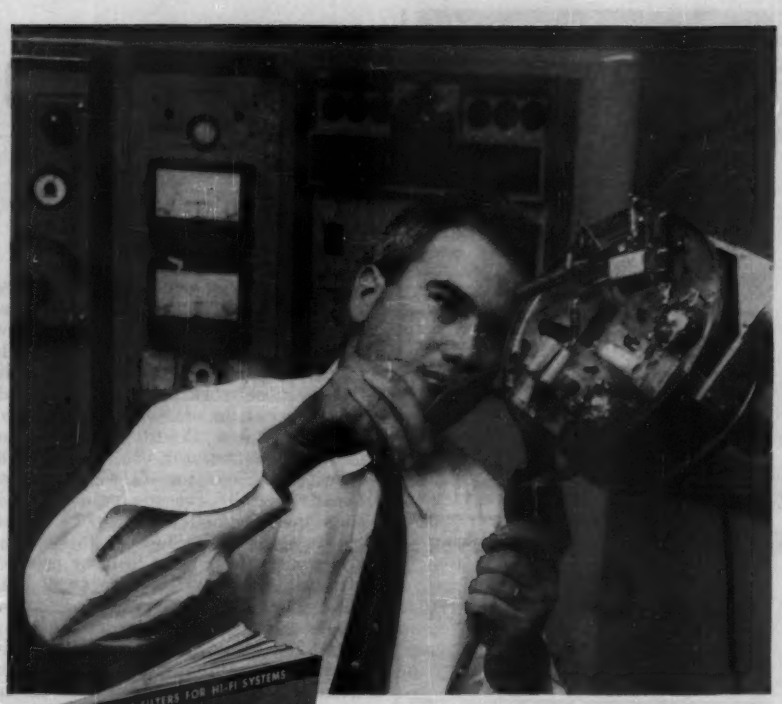
EDISON AWARD NOMINATIONS

THE nation's 150,000 licensed amateur radio operators again will be honored in General Electric's annual Edison Amateur Award for public service. Nominations are now open for the 1957 trophy.

The principal winner will receive a trophy and $500 at a presentation banquet in Washington, D. C. in February. Special citation winners are awarded plaques in recognition of individual public service. When occasion warrants, the judges award commendation certificates to radio amateurs participating in group activities such as hurricane and flood emergency communications.

As in past years, letters of nomination may be submitted by an individual or group on behalf of radio amateurs who have performed an outstanding public service during 1957. The nominations must include the amateurs' names, addresses, radio call letters, and full descriptions of the public services rendered. To qualify for the 1957 program, nominations must be postmarked not later than Jan. 3, 1958, and mailed to the Edison Award Committee, General Electric Co., Owensboro, Ky.

Judges for the 1957 award will be Rosel Hyde, commissioner, Federal Communications Commission; E. Roland Harriman, chairman, American National Red Cross; and G. L. Dosland, president, American Radio Relay League. The award is sponsored by G-E's electronic components division. —50—



IF THIS MAN IS ON YOUR CHRISTMAS LIST—

A subscription to RADIO & TV NEWS will make a perfect gift for him, and every other man with a stake in electronics.

If he makes his living in electronics or is an advanced hobbyist who loves Hi-Fi, Radio, TV, Audio, R/C, ham radio and communications, he'll be delighted to get RADIO & TV NEWS as a gift. For RADIO & TV NEWS offers the best technical coverage in the field. It provides men in electronics with tips and techniques on repairing, installing and maintaining radio and TV sets and circuits, latest Hi-Fi developments, newest ham techniques, fresh audio ideas, test equipment, and current industry news. There is no more thoughtful Christmas gift, or flattering one, than a subscription to RADIO & TV NEWS, the first and most authoritative magazine in the field. Each of your gift subscriptions will be announced by an attractive card, inscribed with your name. What's more, you can enter or extend your own subscription to RADIO & TV NEWS at these special Christmas gift subscription rates, too!

First 1-year gift subscription.....$4
Each additional 1-year gift subscription.....$3

Fill in and return the postage-paid envelope facing this page for your own and gift subscriptions. List additional gift orders on an extra sheet of paper.

WRAP UP YOUR CHRISTMAS GIVING NOW! DO IT EASILY, AND APPROPRIATELY, WITH *RADIO & TV NEWS*

ZIFF-DAVIS, INC. PUBLISHERS

RADIO & TV NEWS • 64 EAST LAKE ST. • CHICAGO 1, ILLINOIS

The Magic of Color

and trucks. We've got to freshen up our personal appearance, improve our

SAVE ½ — PAY PART-BY-PART — HAVE FUN
Assembling the SCHOBER

RADIO ELECTRONIC
SURPLUS

APG 15 INDICATORS

Easily converted to a MODULATION INDICATOR unit, contains a 2AP1 tube with shield; also 9006 tube, miscellaneous potentiometers and resistors.
Brand new $5.00 each
Conversion data to miniature modulation indicator with schematic $1.00

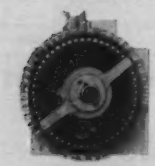
WALKIE TALKIES

Complete Walkie Talkie assemblies as shown, less tubes & case. Crystal controlled, and covers 3500kc to 6000 kc. Brand new. $9.95 each 2 for $17.95

AN/CRC-7 VHF TRANSCEIVER

With voice or transmit tone, used with air-sea rescue work. Crystal controlled. 140.58 mc.
$15.00 each (less battery)

44 POSITION STEPPING SWITCH



With automatic reset. 24 volt A.C. Dimensions 4 ¼" x 4 ¼" x 3" deep. Mfgd. by Wico.
$3.00 each
Five for $12.50 postpaid

OIL CONDENSERS

10 mfd 600 volt D.C. with mounting brackets. Mfgd. by G.E. 95c each
4 mfd 600 volt D.C. 50c each
2 mfd 600 volt D.C. 35c each
Minimum order $2.50.

BC 659 FM TRANSCEIVER

27-39 mc. Used, good condition.....$6.95

BC603 FM RECEIVERS

20 - 27 mc. Used, good condition. $6.95

C & H SALES CO.
2176 E. Colorado St. Pasadena 8, Calif.

YES! WE'LL FOOT
THE SHIPPING BILL
and also send you
FREE
WITH YOUR ORDER—THE INVALUABLE 216 PG. BOOK
"Maintaining Hi-Fi Equipment"
FOR IMMEDIATE DELIVERY:

Wollensak T1500	$189.50	Fisher FM90X	$169.50
Viking FF75BR	113.00	G.E. (VRII) 40052	19.33
Bogen DB130	119.95	Collaro TC-540	46.50
Norelco Continental	269.50	AR-1	185.00
Leak TL/50	149.00	Tanberg 2F or 3	299.50
Janszen 1-30M	184.00	Fairchild 412-4	186.50
Fisher TA-500	349.50	Weathers MM-1	92.10
Shure Dynetic M16	79.50	Pentron NC-38	319.95
Garrard TPA/10	24.50	Fisher 90-T	239.50
Fleetwood 800	299.50	Har-Kardon TA-12	139.50
Pickering 370-1D	39.85	Fisher 125AX	229.50
Dynakit (Mark) III	79.95	Acro Linear II Kit	79.95
Bogen KD82009F	69.50	Bogen R-660	122.50

So step on it! Take advantage of our low prices, prepaid shipments and free book offer. Order Now! All units brand new in factory sealed cartons w/full mfgr's warranty. Full payment or 25% dep. bal., C.O.D.
REY ELECTRONICS CO.
320 LIBERTY ST., N. Y. C. N. Y., DEPT. D3

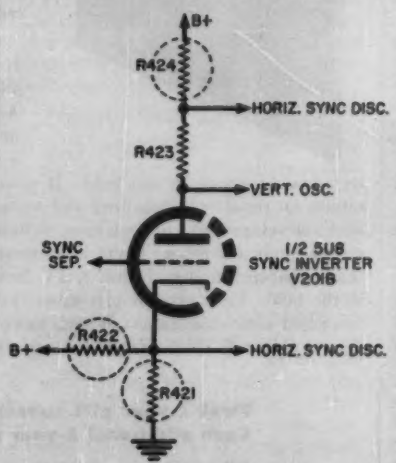
VIDEO OVERLOAD, PHILCO

In some areas, owners of *Philco* TV sets using the TV-300 or TV-301 chassis may be troubled by a tendency for video signal to overload too readily. If this is encountered, the components in the a.g.c. network should be checked. In earlier runs, the a.g.c. filter capacitor, C_8, was .15 μfd., and the value of the a.g.c. resistor, R_{31}, was 560,000 ohms. Also, resistor R_{30} was 1.5 megohms. If these are the values found, then the overload level can be raised by changing the values of these components to those used in later production, as follows: C_8 becomes .22 μfd., R_{31} becomes 470,000 ohms, and R_{30} becomes 1 megohm.

If difficulties are encountered in achieving good vertical centering on these chassis, the grid resistor of the vertical oscillator may be the culprit. If this component, R_{13}, is found to be 470,000 ohms, replacing it with another unit whose value is 680,000 ohms should be all that is necessary to clear up the difficulty.

UNSTABLE SYNC IN ADMIRAL

Portable TV receivers with 10-in. or 14-in. tubes, using the 14YP3 chassis may show a tendency toward sync instability when high contrast levels are used. Since reduction of contrast may



not always be considered desirable to correct this condition, stability under these conditions can be improved by some changes in the sync inverter stage, V_{201B}. Involved in the change are three resistors, two in the cathode circuit and one in the plate, as shown in the accompanying illustration. Resistors R_{426} and R_{425}, in the cathode and plate, respectively, were each 4700 ohms in the original circuit. They are changed to 3300 ohms each. Resistor R_{423}, originally 39,000 ohms, is changed to 47,000 ohms.

Also horizontal instability (drift) may occur on some of these sets. If it does, check the capacitor across the horizontal lock coil, L_{401}. This .0039-μfd. unit, C_{438}, may be a paper tubular type. If it is, changing to a mica capacitor of the same value should minimize changing value of the capacitor during operation, with the consequent elimination of drift.

BENDIX T14 AND T17 CHASSIS

If the screen bypass capacitors in the i.f. amplifiers of these chassis should become defective and require replacement, great care should be taken in checking the characteristics of the replacements. These 680-μμfd. units have been designed to be resonant in the 40-mc. band, and this characteristic is used in the design of the i.f. circuit. Replacement with units of the correct nominal value which do not, however, have the other characteristics can have an adverse effect on operation of the i.f. stages.

On T14-3 chassis using 27-inch picture tubes, there may be some difficulty in obtaining sufficient width to fill these larger CRT's. This insufficiency can be overcome by increasing the screen voltage on the horizontal output tube, a 6CD6G. Simply shunt the existing screen-grid resistor, R_{428}, with another 100,000-ohm unit with a power rating of ½ watt.

EMERSON, CHASSIS 120169

Most likely to occur in fringe areas, black, horizontal streaks may appear over the picture on Channel 6, or sometimes on Channel 5 or 7. This condition can be varied by manipulation of the fine-tuning control, when it occurs. The cause of this condition lies in the fact that the video detector acts as a harmonic generator for signals fed to it in the i.f. band. Some of the harmonics fall within the bandwidth of the affected channels, and, being coupled back to the front end, can set up the regeneration that results in the streaks. The symptom can be eliminated by inserting a choke between the output of the video detector and the input to the video amplifier. Correct point for inserting the choke, which should have a value of 10 or 20 microhenrys, can be traced from video test point *D*. To this point is connected one end of the coupling capacitor to the grid of the video amplifier, a .047-μfd. unit designated as C_{22}. The lead from this capacitor is severed from the test point and the choke is inserted between the test point and the capacitor lead which has just been freed. The lead from the choke to the test point should be kept as short as possible, with the choke close to the point. The other lead from the choke and C_{22} can be anchored together using a vacant terminal on the terminal strip next to the video amplifier, V_5, a 6CB6.

—30—

1957 INDEX
Always

The Magic of Color

(*Continued from page* 50)

them the privilege of repairing their own sets if they think they can.

"The public does not think very highly of us. Lots of people think we are crooks—not much better than highway bandits. They think it is outrageous that we should charge five dollars or more for a home service call.

"Who is responsible for this low opinion the public has of TV servicemen? Who is responsible for driving people into drug stores and supermarkets to buy tubes? I'll tell you, fellows—*we* are.

"We claim to be top-flight, trained TV technicians. Do we look like it? Do our shops look like headquarters for efficient, capable service? Do our service cars and trucks, our dress and bearing, leave the impression that we are responsible, trustworthy, capable businessmen?

"Tomorrow morning when you go to your shop, park across the street and look at your place. Forget that it is your shop—your place of business. Put yourself in the shoes of a customer who doesn't know you. What sort of an impression do you get?

"Believe me, fellows, if we want to win the confidence and the respect of the public we've got to clean up and brighten up our shops, service cars, and trucks. We've got to freshen up our personal appearance, improve our ways of handling people over the phone, and look and act like members of a professional business. It's not a job for one of us. It's a responsibility for all of us."

The dealer who presented the plan for the service industry to adopt a standard color scheme to be used by all full-time, electronic service shops, recommended that associations make shop modernization and redecoration a city-wide project in their communities. He painted a glowing picture of the public interest that would be generated when twenty-five or thirty shops in different parts of a city suddenly blossomed out with colorful new fronts and window displays, all using the same color scheme, design, and general pattern of decorations.

A marketing expert who was asked for an opinion of the plan said that, if a large number of shops in any city participated in such a program, it would have far-reaching effects in channeling electronic service business into independent shops. "The painting and redecorating of a store," he said, "always stimulates a lot of interest in the business in the community where it is located. If a group of service shops, situated in different parts of a city, painted and redecorated and modernized their stores simultaneously, it would pyramid public interest in the businesses involved in the project."

—30—

SAVE ½ — PAY PART-BY-PART — HAVE FUN

Assembling the SCHOBER

ELECTRONIC ORGAN in KIT form

Now you can afford a real, full concert organ, just like those made by the foremost organ manufacturers. Because over ½ the cost is saved when you assemble it yourself. And it's REALLY EASY: only 24 separate units, all with printed circuits, and detailed-to-the-smallest-step instructions. In addition, you purchase each of the 24 kits when you are ready for it — and can afford it.

You'll get a real kick out of putting the Schober Electronic Organ* together — and then sitting down and pulling the stops for Strings, Trumpets, Clarinets, Diapasons, Flutes, etc. Electronic Percussion optional; chimes available.

Compact CONSOLE

One of the many exclusive features of this exceptional organ is the handsome console, in a wide variety of finishes. It is equally at home in a traditional or modern setting, and takes little more space than a spinet piano.

Free Literature

Complete descriptive booklet and price list are available on request. And, if you wish to hear the glorious pipe organ tone of the Schober Electronic Organ, a 10" long-playing demonstration recording is available for $2. This is refundable when you order. Write today and see what a fine instrument you can get at such a great saving.

The SCHOBER ORGAN CORP.

2248-R Broadway, New York 24, N. Y.

*Designed by Richard H. Dorf

FEATURING FAMOUS FACTORY

TUBES

- INDIVIDUALLY BOXED!
- GUARANTEED ONE YEAR!
- FACTORY BOXED
- FACTORY IRREGULARS
- NEW JAN SURPLUS
- EQUIPMENT TUBES

ALWAYS 1000 TYPES IN STOCK

EXPORT ORDERS INVITED — MANUFACTURERS ORDERS INVITED

We Are Not Selling Price— We Sell Only Quality

Used Tubes, Electrically Perfect Factory Seconds, Brand New Factory Seconds and New and Used Jan Surplus Tubes.

REMEMBER—You Buy Quality When You Buy Standard. Quality Never Shouts—It Always Whispers.

FREE 12" TV SET

with every receiving tube order of $100.00 or more!

FREE 16" TV SET

with every receiving tube order of $200.00 or more!

Bonus TV sets are shipped complete with cabinet and picture tube F.O.B. our warehouse. With slight adjustments and minimum labor they can be restored like new.

Below Is A Partial List—Send For FREE Complete List and Order Form

0Z4	.43	5AT8	.79	6BK7	.75	7A4	.46	12J5	.59
1A7GT	.43	5J6	.79	6BL7GT	.74	7A5	.52	12L6	.59
1B3GT	.66	5T8	.79	6BN6	.79	7A6	.44	12SA7	.47
1C5GT	.40	5U4G	.79	6BQ6GT	.79	7A7	.44	12SD7	.44
1C6	.25	5U8	.79	6BQ7	.75	7A8	.44	12SJ7	.44
1C7G	.25	5V4G	.57	6BY5G	.57	7AU7	.69	12SK7	.47
1D5GP	.42	5V4GT	.49	6BZ7	.75	7B4	.45	12SL7GT	.47
1H4G	.45	5X8	.79	6C4	.36	7B5	.40	12SN7GT	.56
1J6GT	.45	5Y3	.38	6C6	.50	7B6	.41	12SQ7	.39
1L4	.45	5Y4G	.42	6CD6G	1.17	7B7	.41	12V6GT	.44
1L6	.54	5Z3	.44	6CU6	.79	7B8	.46	12W8	.59
1LA4	.58	6A7	.56	6D6	.47	7C4	.45	12X4	.36
1LA6	.48	6A8	.46	6E5	.43	7C5	.41	14A7	.44
1LB4	.48	6AB4	.44	6F5	.36	7C6	.42	14B8	.44
1LC6	.48	6AC7	.66	6F6	.37	7C7	.44	14Q7	.44
1LC8	.48	6AF4	.78	6H6	.37	7E5	.44	19T8	.89
1LD5	.58	6AG5	.49	6J4	1.59	7E6	.44	19BG6G	1.17
1LE3	.36	6AG7	.68	6J5	.38	7E7	.44	25BQ6GT	.84
1LH4	.43	6AH4GT	.69	6J6	.48	7F7	.85	25CA5	.79
1LN5	.48	6AK5	.79	6K6GT	.38	7F8	.74	25CD6	1.39
1N5GT	.49	6AK6	.53	6K7	.38	7G7	.74	25CU6	.99
1R5	.50	6AL5	.41	6L6	.67	7H7	.67	25L6GT	.46
1S5	.48	6AM8	.79	6N7	.59	7Q7	.58	25W4GT	.42
1T4	.50	6AQ5	.79	6Q7	.39	7S7	.64	25Z6	.36
1U4	.48	6AQ8	.48	6S4	.39	7Y4	.34	27	.34
1U5	.48	6AS5	.47	6S8GT	.47	7Z4	.34	35B5	.47
1V2	.70	6AS7G	2.25	6SA7	.49	12A4	.39	35C5	.47
1X2	.88	6AT6	.38	6SB7Y	.78	12A6	.40	35L6GT	.46
2A3	.49	6AT8	.79	6SC7	.47	12AB5	.59	35W4	.38
2A7	.60	6AU4GT	.60	6SD7	.60	12AD6	.59	35Y4	.38
2D21	.88	6AU6GT	.60	6SH7	.43	12AE6	.40	35Z3	.40
3A4	.50	6AU8	.62	6SJ7	.42	12AT6	.40	35Z5GT	.38
3A5	.52	6AV5GA	.79	6SK7	.38	12AT7	.65	36/44	.35
3AL5	.53	6AV5GT	.64	6SL7GT	.56	12AU6	.41	50A5	.47
3AU6	.53	6AV6	.38	6SN7GT	.56	12AU7	.69	50B5	.47
3BZ6	.59	6AW8	.89	6SQ7	.40	12AV6	.41	50C5	.47
3BC5	.57	6AX4GT	.68	6SS7	.40	12AV7	.86	50L6GT	.44
3BN6	.67	6AX5GT	.58	6T4	.85	12AX4GT	.64	80	.39
3C5G	.57	6BA6	.45	6T8	.81	12AX7	.82	84/6Z4	.45
3Q4	.58	6BC5	.49	6U5	.44	12AZ7	.83	117L7GT	1.25
3Q5GT	.46	6BC8	.89	6U8	.79	12BA6	.48	117N7GT	1.35
3S4	.46	6BD6GT	.53	6V3	.79	12BA7	.59	117P7GT	1.35
3V4	.58	6BE6	.45	6V6GT	.45	12BE6	.48	117Z3	.36
4BQ7	.75	6BF5	.39	6W4GT	.38	12BH7	.89	117Z6GT	.61
4BZ7	.72	6BQ6G	1.17	6W6GT	.52	12BY7	.83		
5AM8	.79	6BR8	.80	6X4	.38	12CA5	.79		
5AN8	.79	6BS8	.87	6X5	.38	12CU6	.79		
5AQ5	.49	6BK5	.67	6X8	.74	12DQ6	.79		

Receiving Tubes Sent Parcel Post

FREE! TWO SET COUPLER WITH EVERY TUBE ORDER OF $8.50 OR MORE!!

FREE POSTAGE! On All Orders Shipped In U. S. A., Territories and A.P.O.'s. Send 25c for handling on orders under $5.00. Please send approx. postage on Canadian and foreign orders. Excess will be refunded.

STANDARD LINE

ELECTRIC COMPANY

412 HARRISON AVENUE, HARRISON, N. J. - Phone: HUmboldt 4-4997

Interference Problems on Small Boats (Robberson) ..... 38 May
Mac's Service Shop (Frye) ..... 76 Jan

TUBE SALE!

EARN TOP SALARIES! BUILD AN EXCITING FUTURE! READ:

YOUR CAREER IN ELECTRONICS

A NEW ZIFF-DAVIS PUBLICATION

This fact-filled volume prepared by the combined staffs of RADIO & TV NEWS and POPULAR ELECTRONICS is written for men who have a stake in the fastest-growing industry in the world—electronics! If you're eager and ready to move into a more advanced, higher-paying electronics specialty or want to begin an electronics career, don't miss this informative 132-page publication.

IT TELLS YOU

- what job opportunities are available in electronics
- how to prepare for a job in electronics
- how to get a job in electronics

CONTENTS

ELECTRONS, SLIDE RULES AND YOU—Careers in Electronics . . . Am I Too Old to Learn Electronics . . . Women in Electronics . . . What About Tech Writing? . . . Electronics Stands Guard

CAREERS IN PROGRESS—I am an Atomic Engineer . . . I Ride the Satellites and Rockets . . . I Make Electronic Brains . . . Thank Me for Safe Air Travel . . . We Make Color TV . . . We're Looking for Tomorrow

SURVEY OF THE JOB MARKET—Personnel requirements of the largest electronic manufacturing firms—number of technicians, engineers needed, kind of background required, salaries offered, training given and opportunities for advancement.

COURSES, CREDITS AND DEGREES—Training for a Career . . . Home Study . . . College Training . . . Resident Schools

ELECTRONICS IS A PROFITABLE HOBBY—Spare Time TV Servicing . . . Use Your Hi-Fi Know-How . . . Build Gadgets for Money . . . Kits For Sale . . . Profit From P.A. Rentals

BASIC ELECTRONICS—A brief course in the fundamentals of electronics. It gives the beginner a knowledge of terminology and some familiarity with the electronics field.

Buy a Copy of
YOUR CAREER IN ELECTRONICS
ON SALE NOW AT ALL NEWSSTANDS—only 75c

1957 INDEX VOLUMES 57-58

As a service to our readers we are again presenting a complete listing of all feature articles which appeared in RADIO & TV NEWS during 1957. We suggest you keep this for reference.

AMATEUR

ANTENNAS

Shortened Rotary Beam Antennas for the Amateur (Brier, W9EGQ). 72 Jan.
TV Lead-in Serves as S.W. or B.C. Band Antenna (Falk). 122 Mar.

HAM GEAR

Adjustable Half-Wave Filter (Hooton, W6TYH). 62 Apr.
Coax Line R.F. Monitor (Lewis, W8MQU). 43 Nov.
Conelrad the Easy Way (Frye, W9EGV). 66 Apr.
Consonant Amplifier-Limiter (Daniel, W5KYO/6). 49 Mar.
High-Stability Oscillator Circuit (Ropes). 142 June
One-Tube, 10-Meter Transceiver (Fleming, W8ZXL). 58 June
Single-Sideband Receiving Adapter (Hooton, W6TYH). 71 Nov.
"Super-DX" 15-Meter Converter (Hooton, W6TYH). 52 May
Super Selectivity with Crystals (Burns, W9NVC). 52 July
Transistorized Amateur Transmitter —45,000 Miles-per-Watt (Fallgren, W1OGU & Hankinson, W1OSF). 37 Feb.
Transistorized Ham Converter. 164 Oct.
Transistorized Supply for Mobile Radio (Najork). 56 Sept.
Transistorized 10-Meter Receiver (Lindsay, W7BSS & Parker, W8QVC). 61 Sept.
Two-Mater Amplifier (Stratman). 70 Oct.

MISCELLANEOUS

Ham Communications from President's Train. 111 Jan.
Mary Burke, W3CUL, Wins 1956 Edison Award. 78 Apr.
Ninth National ARRL Convention. 100 Apr.
Operation Jupiter (Burnham). 35 Aug.
"Operation Smoke-Puff" (Villard, Jr., W6QYT & Rich, W6OPX). 126 June
Record Set for 144-mc. Contact. 172 Oct.

AM-FM

RECEIVERS

Multiband FM Receiver (Bohr). 66 June
New FM Kit for Hi-Fi. 46 Aug.

SERVICING

Adding "Volumatic Control" (Cohn). 146 June
Common-Sense Troubleshooting (Garrett). 58 Feb.
Cover Story. 75 Oct.
Delco's All-Transistor Auto Radio. 60 Aug.
Delco's Portable Auto Radio. 44 Dec.
FM Tuner Alignment Problems (Burstein & Pollak). 73 Sept.
Fringe-Area FM Reception (Bramham). 39 Aug.
Interference-Free AM Reception (Tooker). 54 Nov.
Frequency Modulation Engineering (Tibbs & Johnstone). 156 Jan.

A ....Always
B ....Buy
C ....Columbia

APR-5 UHF RECEIVER: 1000-5000 MC. 30 MC. I.F. 1 mil meter. Excellent condition. Wonderful buy! $75.00

GN-38F DUAL VOLTAGE GENERATOR. Outputs: 1,000 VDC @ 350 MA; 12 VDC @ 25 amps. NEW—original boxes. Ship. wt. approx. 100 lbs. A COLUMBIA SUPER BUY $8.88

RCA TV CAMERA! NEW!
1848 Iconoscope, 6-stage video amplifier and clipper. Dozens of uses for lab work, industry, closed circuit TV, etc. ONLY $149.50

BC-604 TRANSMITTER R
20-27 MC. 30 W. output. Less input xfrmr, tubes. New and like new cond. Wt. Approx. 30 lbs. $3.95

MOTOROLA 6 V. FM TRANSMITTER
25 W. input. 150-170 MC. Complete with tubes and power unit. Excel. cond. SWELL BUY! $34.95
SAME AS ABOVE except range is 30-50 MC. Good cond. $34.95

FRA FREQUENCY SHIFT RECEIVER CONVERTER: For teletype. Has 400 kc IF. Excellent cond. Only $39.95

COMMAND GEAR ROUND-UP
RECEIVERS—Excel. Cond.

G-R'ER 190-550 kc.	$12.95
1.5-3 MC.	7.95
3-6 MC.	4.95
R-28 VHF 100-156 MC.	17.50
TRANSMITTERS—Excel. Cond.	
2-3 MC.	$ 4.95
3-4 MC.	4.95
4-5 MC.	3.95
4-5 MC. BRAND NEW	5.95
5.3-7 MC.	3.95
5.3-7 MC. BRAND NEW	5.95
7-9 MC.	3.95
T-23 100-156 MC.	12.95
BC-456 Modulator Screen	$4.95
MD7/ARC-5 Modulator Plate	9.95
BC-442 Antenna Relay	2.95
STACKS OF RACKS	
For Single Recvr.	$5.00
For Dual Recvr.	2.50
For Single Xmtr. Are-5	5.00
For Dual Xmtr.	2.50
Triple Receiver Rack: A best buy for only	2.95

ALSO AVAILABLE: 18 ft. Plex Cable $1.95. Control Boxes. Ea. $1.00. Plugs. Each, $1.00. ORDER NOW!

All orders FOB Los Angeles. 25% deposit required. All items subject to prior sale. NOTE: MINIMUM ORDER $3.00. TO EXPEDITE YOUR ORDER MAIL TO DEPT. R.

Columbia ELECTRONICS
2251 W. WASHINGTON BLVD.
LOS ANGELES 18, CALIFORNIA

FINAL SALE!

GIANT KITS For Experimenters, Servicemen, Repairmen

SACRIFICING $30,000 stock at 5¢ on the Dollar! Our Loss is Your Gain! Two sizes of Giant Kits, each with BRAND NEW, usable parts for ham transmitters and receivers. Consist of: Wire wound and metallized resistors; By-pass and filter condensers; Variable, padding, and trimming condensers; Input, Output, Power transformers; RF and Audio-filter chokes; Volume Controls; Assorted Knobs; Hook-up wire; gang switches; Chassis; Voltage dividers; Receiving and transmitting sockets, all sizes . . . PLUS MORE!

TOTAL RETAIL VALUE OVER $100

60-lb. kit $12.95
50-lb. kit $9.95
Freight or express shipments only. FOB Newark. NO COD. full amount MUST accompany each order. Write Dept. RTV

UNITED RADIO COMPANY
58 Market Street, Newark, N. J.

ELECTRONICS

PREPARE FOR A GOOD JOB!
BROADCAST ENGINEER
RADIO SERVICING AUTOMATION
TELEVISION SERVICING
BLACK & WHITE—COLOR
APPROVED FOR VETERANS AND SURVIVORS OF VETERANS
BUILDING AIR CONDITIONED
SEND FOR FREE LITERATURE
BALTIMORE TECHNICAL INSTITUTE
1425 EUTAW PLACE, BALTIMORE 17, MD.

Interference Problems on Small Boats (Robberson) ..... 38 May
Mac's Service Shop (Frye)..... 76 Jan.
Mac's Service Shop (Frye)..... 76 Feb.
Mac's Service Shop (Frye)..... 72 Apr.
Mac's Service Shop (Frye)..... 62 Aug.
1957 Auto Radios: Chevrolet..... 37 Apr.
1957 Auto Radios: Dodge-Chrysler Corp. ..... 46 May
1957 Auto Radios: Ford..... 40 July
Noise-Compensated Car Radio Volume .....125 Oct.
Servicing Low-Power Industrial 2-Way Radios (D'Elia) ..... 73 Oct.
Servicing Three-Way AM Radios (Johnson) ..... 46 Dec.
Testing FM Tuners at Home (Hirsch) ..... 40 Nov.
Transistor Radio Troubleshooting (Gottlieb) ..... 54 Dec.

COMPONENTS

Batteries for Transistor Radios..... 40 June
Component Checking (Crowhurst).. 64 Feb.
Service Techniques for Modular Circuits (Bernstein) ..... 60 Jan.

BOOK REVIEWS

Acoustics for the Architect (Burris-Meyer & Goodfriend).....183 Oct.
Acoustical Engineering (Olson)....156 Sept.
Additional 1957 Television Servicing Information (Beitman, ed.)...186 Oct.
Analysis of Bistable Multivibrator Operation (Neeteson) .....184 Feb.
Antennas (Schure, ed.).....139 June
Applied Analysis (Lanczos).....114 Apr.
Automatic Record Changer and Tape Recorder Service Manual (Sams Staff) .....184 Oct.
Auto Radio Removal (Sams Staff)..105 July
Auto Radio Service Data Manual (Sams Staff) .....104 July
Basic Mathematics for Electricity, Radio, and Television (Singer)..150 Nov.
Basic Mathematics for Radio and Electronics (Colebrook & Head)..148 Nov.
Basic Physics (Effron).....169 Dec.
Basic Radio & Radio-Receiver Servicing (Zbar & Schildkraut)..... 156 Jan.
Building an Engineering Career (Williams & Farber).....139 June
Calculus Refresher for Technical Men (Klaf) .....164 Mar.
Circuit Theory and Design (Stewart) .....181 Feb.
Dave Rice's Official Pricing Digest (Rice) .....165 Mar.
Dave Rice's Official Pricing Digest (Rice) .....120 Aug.
Dry Battery Receivers with Miniature Valves (Rodenhuis)..... 169 Dec.
Electrical Engineering Circuits (Skilling) .....105 July
Electricity and Electronics—Basic (Steinberg & Ford).....184 Oct.
Electronic Metal Locators (Renne)..115 Apr.
Electronic Musical Instrument Manual, The (Douglas).....137 June
Electronic Shortcuts for Hobbyists (Semiconductor Div. Staff, Sylvania Electric Products Inc.)....170 Dec.
Electronic Tubes, Circuits, and Devices (Blevins) .....156 Jan.
Elements of Radio (Hellman)..... 160 Jan.
Energy (Lodge) .....104 July
Equivalent Radio Tubes—"Vade-Mecum" (Gijsen, ed.).....140 June
First One Hundred and Fifty Years, The (House of Wiley).....139 June
FM Stations Up-To-Date (Cramer).. 170 Dec.
Foundations of Radio (Scroggie).. 139 June
40 Uses for Germanium Diodes (Semiconductor Dept. Staff, Sylvania Electric Products Inc.)....170 Dec.
Frequency-Modulated Radio (Sturley) .....128 May
Frequency Modulation (Arguimbau & Stuart).....115 Apr.
Radio-Television and Basic Electronics (Oldfield) .....163 Mar.
Radio Valve Data ("Wireless World" Staff) ..... 181 Feb.

TUBE SALE!

UNBRANDED TV AND RADIO TUBES
FULL 90 DAY GUARANTEE
STOCK UP NOW AT TREMENDOUS DISCOUNTS
Tubes Not Listed Below Are Unavailable

Tube No.	Each	Tube No.	Each	Tube No.	Each	Tube No.	Each
1B3	$0.78	6AU4	$0.91	6CB6	$0.63	12B4	$0.76
1L6	.87	6AU5	1.09	6CD6	1.56	12BA6	.57
1R5	.70	6AU8	.97	6CG7	.69	12BE6	.60
1S5	.61	6AW8	.99	6CG8	.87	12BY7	.84
1U4	.66	6AX4	.73	6CM7	.76	12DQ6	1.17
1U5	.58	6BA6	.57	6CN7	.69	12J7	.91
1X2	.81	6BE6	.63	6CU6	1.17	12Q7	.76
2AF4	1.09	6BG6	1.66	6DQ6	1.17	17AX4	.76
3CB6	.63	6BJ6	.70	6J6	.76	17DQ6	1.17
3V4	.66	6BK5	.88	6SN7	.70	19T8	.94
5BK7	.96	6BK7	.94	6U8	.88	25L6	.61
5U4	.57	6BL7	1.06	6V6	.60	25Z6	.73
5Y3	.46	6BN6	.81	6W4	.64	35C5	.60
6AB4	.55	6BQ6	1.17	6X8	.87	50C5	.60
6AF4	1.08	6BQ7	1.06	12A8	.99	Government Tubes	
6AH4	.84	6BU8	.78	12AT6	.48	6H6	.72
6AL5	.49	6BX7	1.08	12AT7	.85	6SH7	.91
6AQ5	.60	6BZ6	.63	12AX4	.73	6SL7	.88
6AQ7	.91	6BZ7	1.08	12AX7	.69	1625	1.05

50 ASSORTED PORCELAIN WIRE WOUND RESISTORS
5-10-20-Watt
Kit..... **$5.95**

GOLDEN VOICE 6" x 9" PM SPEAKER WITH NOISE FILTER
3.15 oz. Magnet
3.2 ohm Voice Coil
Each..... **$4.19**

100 ASSORTED CERAMIC CONDENSERS
Kit..... **$2.95**

100 ASSORTED MICA CONDENSERS **$2.95**

25—VOLUME CONTROLS AND POTENTIOMETERS
Kit..... **$3.25**

SURPRISE PACKAGE
Approximately 10 lbs. of Assorted Radio & TV Parts—Every Part New—Every Part Useable..... **$4.95**

100—TV AND RADIO KNOB KIT
Always A Must for Every Serviceman. Kit.... **99c**

25—VOLUME CONTROLS WITH SWITCHES
All Popular Sizes
Kit..... **$5.95**

10—ASSORTED BAKELITE CABINETS
Sell 1 Cabinet and Get Back Your Entire Investment. Kit..... **$2.95**

VM—45 RPM ADAPTOR
Each..... **$1.98**

WEBCOR—45 RPM ADAPTOR
Each..... **$1.98**

25—ASSORTED ELECTROLYTICS
Popular Sizes
$50.00 Value
Per Kit..... **$6.95**

25—ASSORTED OUTPUTS AND CHOKES
ALL NEW
Kit..... **$7.95**

100—ASSORTED PAPER AND MOLDED TUBULAR CONDENSERS
POPULAR BRANDS & SIZES
Kit..... **$4.95**

All Orders 25% Deposit—Balance C.O.D.

MAJESTIC ELECTRONICS LTD.

2419 SOUTH MICHIGAN AVENUE CHICAGO 16, ILLINOIS

HAM WANTED
top money for his gear so he sold it to us!
WE URGENTLY NEED:
ART-13 BC-224
BC-348 APN-9
VRC, PRC, TRC & GRC EQUIP.
What else do you have?
J. J. CANDEE CO. Dept. RN
4602 W. Burbank Blvd., Burbank, Calif.
Phone Victoria 9-2411

2 WAY PORTABLE RADIO SET

Sends—Receives up to 10 miles as shown or hundreds of miles with outside antenna! 80 and 40 meter amateur radio bands (novice) also Aircraft and overseas broadcasts (3 to 8 mc.) POWERED WITH SELF-CONTAINED PORTABLE RADIO BATTERIES. NO AC PLUG-INS NEEDED! Take it with you everywhere you go—Keep in contact with home, friends. Has 5 watt crystal controlled transmitter—Sensitive Regenerative Receiver. Send receive switch. Wt. only 3 lbs. Size, only 6"x4"x4". TESTED — PROVEN — SIMPLIFIED—PRACTICAL—Full information given on quick easy to get license.

SEND ONLY $3.00 (bill, ck, mo) and pay postman $11.95 COD postage on arrival or send $14.95 for postpaid delivery. Complete kit includes all parts, tube, coils, plastoid cabinet, easy instructions. (Set of batteries—$2.95; crystal $1.25). COMPLETELY WIRED AND TESTED POSTPAID $19.95. A regular $49.95 value—Order now before price goes up. GUARANTEED —AVAILABLE ONLY FROM:
WESTERN RADIO Dept. SNT-12 KEARNEY, NEBR.

Now In Stock For Immediate Delivery!

The First...

...and still the Best TV Chassis Design!

CUSTOM 630 by TECH-MASTER

A decade ago it was the first... and the best. Today, it is still the finest. Incorporating the latest design improvements in the famous 630 circuit, such as the exclusive 3-tube synchrolok for picture stability, TECH-MASTER has produced a 30-tube chassis that provides incomparable viewing fidelity.

TECH-MASTER CORPORATION, 75 FRONT STREET, BROOKLYN 1, N. Y.

CODE SENDING RECEIVING SPEED

Be a "key" man. Learn how to send and receive messages in International Morse code. Communicate with operators around the globe. Learn at home quickly through famous Candler System. Used by best operators. Qualify for Amateur or Commercial License. Write for FREE BOOK.

CANDLER SYSTEM CO.
Dept. 2-O, Box 928, Denver 1, Colo., U.S.A.

TV SERVICEMEN!
Write for SENSATIONAL CATALOG
HENSHAW RADIO SUPPLY
3619 TROOST KANSAS CITY, MO.

TELEVISION

Industry needs Electronic Trained Men Now! Qualify for BIG PAY JOB, 9 short months. No other type of training can compare with actual shop practice you get at Healds under expert instructors.

Bachelor of Science Degree, 27 Months

- ☐ Electronics Engineering (B.S. Degree)
- ☐ Electrical Engineering (B.S. Degree)
- ☐ Television Technician (9 Months) ☐ Color TV
- ☐ Electronics Technician (12 Months)
- ☐ Mechanical Engineering (B.S. Degree)
- ☐ Civil Engineering (B.S. Degree)
- ☐ Architecture (B.S. Degree)

Heald College ranks FIRST West of the Mississippi in "Who's Who in America"

Approved for Veterans
DAY AND EVENING CLASSES
Register Now. Write for Catalog.
(No Obligation.)

Your Name .....
Address .....
City .....
State .....

AT HEALDS YOU LEARN BY DOING IN MODERN ELECTRONICS LABORATORIES

HEALD
ENGINEERING COLLEGE
Established 1863
Van Ness at Post, RTN
San Francisco, Calif.

Frequency Modulation Engineering (Tibbs & Johnstone).....156 Jan.
Getting Started in Amateur Radio (Berens).....120 Aug.
Handbook of Basic Circuits (Mandl).....158 Jan.
Handbook of Industrial Electronic Control Circuits (Markus & Zeluff).163 Mar.
Handbook of Semiconductor Electronics (Hunter, ed.).....160 Jan.
Handbook of Sound Reproduction (Villchur).....129 May
Hi-Fi Equipment Yearbook—1957 (Herman, ed.).....137 June
Hi-Fi From Microphone to Ear (Slot).....165 Mar.
How to Install & Service Intercommunication Systems (Darr).....115 Apr.
How to Listen to the World (Johansen).....138 June
How to Make a Transistorized Portable Radio (Sylvania Staff)..150 Nov.
Improve Your TV Reception (Cura & Stanley).....164 Mar.
International Electronic Tube Handbook (Radio Bulletin Staff).....104 July
Introduction to Junction Transistor Theory, An (Middlebrook).....137 June
Introduction to Printed Circuits (Swiggett).....158 Jan.
Introduction to Semiconductors, An (Dunlap, Jr.).....118 Aug.
Introduction to the Cathode Ray Oscilloscope, An (Carter).....184 Oct.
Jω-Or Symbolic Method, The (Stockman).....129 May
L-C Oscillators (Schure, ed.).....128 May
Man of High Fidelity: Edwin Howard Armstrong (Lessing)....182 Feb.
Marine Radiotelephone Permit Q & A Manual (Kaufman).....183 Oct.
Mastering the Morse Code (Schwartz).....104 July
Mathematics and Computers (Stibitz & Larrivee).....128 May
Most-Often-Needed 1957 Radio Diagrams and Servicing Information (Beitman, ed.).....128 May
Most-Often-Needed 1957 Television Information (Beitman, ed.).....158 Jan.
Numerical Integration of Differential Equations (Bennett, Milne, & Bateman).....163 Mar.
Photoconductivity Conference (Breckenridge, Russell, & Hahn, eds.).....156 Jan.
Pictorial Microwave Dictionary (Young & Jones).....184 Feb.
Picture Book of TV Troubles (Rider Staff).....181 Feb.
Pin Point TV Troubles in 10 Minutes (Coyne Staff).....138 June
Practical Radio and Electronics Course (Beitman, ed.).....128 May
Presentation of Technical Information, The (Kapp).....148 Nov.
Proceedings of the Conference on Instrumentation and Control in the Process Industries.....156 Jan.
Proceedings of the 1956 Electronic Components Symposium .....156 Jan.
Proceedings of the RETMA Symposium on Applied Reliability...118 Aug.
Proceedings of the Second RETMA Symposium on Applied Reliability .....156 Sept.
Profitable Radio Troubleshooting (Marcus & Levy).....158 Jan.
Radio (Tucker & Wilkinson).....181 Feb.
Radio Amateur's Handbook, The (ARRL Staff).....129 May
Radio Electronics Made Simple (Schwartz).....158 Jan.
Radio-Electronic Master, The (United Catalog Publishers, Inc.).....182 Feb.
Radio Operator's License Q & A Manual (Kaufman).....157 Sept.
Radio Telemetry (Nichols & Rauch). 164 Mar.
Service Industry and Public Relations (Leonard) ..... 58 Mar.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP,

Radio-Television and Basic Electronics (Oldfield) ..... 163 Mar.
Radio Valve Data ("Wireless World" Staff) ..... 181 Feb.
Receiving Tube Substitution Guide (Middleton) ..... 188 Oct.
Reference Data for Radio Engineers (I. T. & T. Staff) ..... 182 Feb.
Reliable Electrical Connections .... 140 June
Repairing Television Receivers .... (Glickstein) ..... 128 May
Resonant Circuits (Schure, ed.) .... 128 May
Scientific French (Locke) ..... 105 July
Scientific German (Condoyannis) .. 118 Aug.
Semiconductor Abstracts (Battelle Memorial Institute Staff) ..... 156 Sept.
Semiconductors—Their Theory and Practice (Goudet & Meuleau) .... 148 Nov.
Servicing and Calibrating Test Equipment (Kiver) ..... 158 Jan.
Servicing TV AFC Systems (Russell, Jr.) ..... 182 Feb.
Servosystems Laboratory Manual (Servo Corp. Staff) ..... 140 Nov.
Small Appliance Servicing (Brockwell, Jr.) ..... 118 Aug.
Teaching Typewriting Through Television (Passewark) ..... 181 Feb.
Television Engineering Handbook (Fink, ed.) ..... 114 Apr.
Television Explained (Miller) ..... 139 June
Training Manual on Antennas (TechRep Div. of Philco) ..... 114 Apr.
Transistor Circuit Engineering (Shea, ed.) ..... 157 Sept.
Transistor Circuits (Turner) ..... 150 Nov.
Transistor Circuits and Applications (Carroll, ed.) ..... 118 Aug.
Transistor Engineering Reference Handbook (Marrows) ..... 129 May
Transistor Manual (G-E Staff) ..... 148 Nov.
Transistors, Circuits and Servicing (Bettridge) ..... 118 Aug.
Trigonometry Refresher for Technical Men (Klaf) ..... 164 Mar.
TV and Radio Tube Substitution Guide (Cisin) ..... 148 Nov.
TV Antennas (Schwartz) ..... 186 Oct.
TV Consultant (Cisin) ..... 183 Oct.
TV Picture-Tube Chassis Guide (Rider Staff) ..... 120 Aug.
TV Tube Location and Trouble Guide (Rider Staff) ..... 165 Mar.
TV Tube Locator (Cisin) ..... 186 Oct.
TV Trouble Tracer—TV Portables (Cisin) ..... 186 Oct.
Tubes for Computers (Philips Staff). 138 June
Tube Selection Guide 1956-1957 (Kroes, ed.) ..... 138 June
U.H.F. Tubes for Communication and Measuring Equipment (Philips Staff) ..... 138 June
Valve & Television Tube Equivalents (Babani) ..... 104 July
Wave Propagation (Schure, ed.) .. 104 July
Who's Who in Electronics (Electronic Periodicals, ed.) ..... 104 July
World Radio Handbook (Johansen). 138 June

BUSINESS MANAGEMENT

All Your Eggs in One Basket? (Leonard) ..... 56 July
Are You Losing Money? (Leonard). 70 Nov.
Distributors and Service Technicians Join Hands (Leonard) ..... 56 Jan.
Do-It-Yourself Service Center (Leonard) ..... 52 Apr.
Mac's Service Shop (Frye) ..... 74 Dec.
Magic of Color, The (Leonard) .... 50 Dec.
Midget Radio Service is Profitable (Johnson) ..... 64 Sept.
Outlook for Color TV (Gary) ..... 64 Mar.
Professional Standards for Technicians (Leonard) ..... 56 Aug.
Profits in Do-It-Yourself Repairs (Rosen) ..... 56 Oct.
Promote to Survive (Leonard) ..... 48 May
Selling Service (Leonard) ..... 52 June
Service Diversification (Leonard) ... 60 Feb.

Now In Stock For Immediate Delivery!

Order this New Heavyweight Champion

From the World's Largest Distributor of Amateur Radio Equipment!

hallicrafters SX-101

HEAVIEST CHASSIS IN THE INDUSTRY - OFFERS SELECTABLE SIDEBAND - 7 BAND COVERAGE

Here's the top-flight receiver in the field, with seven ham bands on large slide rule dial; 1.8-2.4 Mc., 3.2-4.1 Mc, 7.0-7.3 Mc., 14.0-14.4 Mc., 21.0-21.5 Mc., 26.95-27.35 and 28.0-29.7 Mc., plus special 10 Mc. position for W.W.V. Includes coverage of most important M.A.R.S. frequencies. A dual conversion receiver with the exclusive Hallicrafters upper/lower side band selection, tee-notch filter, 50:1 tuning knob ratio with absolute resetability, built-in precision 100 kc marker crystal, and illuminated dual scale S-meter. S-meter functions with AVC off. Has five steps of selectivity from 500-5000 cycles and precision temperature compensation. 52 ohm antenna input. Direct coupled, series noise limiter. 14 tubes plus voltage regulator and rectifier. Sensitivity: —1 mv or less on all bands. Size: 20"x10½"x16" Shp. wt. 74 lbs.

R-46B Speaker, Wt. 13½ lbs. — $17.95.

$39.50 Down

Cash Price: $395.00

Only $22.12 per mo.

And One of these Top Quality WRL Transmitters

GLOBE KING 500B

Net: $725.00

$72.50 Down

$40.60 per mo.

GLOBE CHAMP 300

Net: $449.00

$44.90 Down

$25.14 per mo.

GLOBE SCOUT 680

Net: $109.95

$10.00 Down

$8.10 per mo.

GLOBE CHIEF 90

Net: $67.80

$6.75 Down

$5.47 per mo.

Brand New . . FREE . . 1958 Catalog

200 PAGES — HUNDREDS OF ILLUSTRATIONS — OVER 15,000 ITEMS LISTED — CHUCK FULL OF BARGAINS FROM THE MAJOR MANUFACTURERS!

SEND FOR YOUR FREE COPY TODAY!

Please Send Me: ☐ Free Catalog . . . ☐ Hallicrafter Information . . . ☐ The WRL Product Story . . . and your ☐ Latest Reconditioned Equipment List:

R-12/7

NAME: _____

ADDRESS: _____

CITY & STATE: _____

WORLD'S MOST PERSONALIZED ELECTRONIC SUPPLY HOUSE

World Radio LABORATORIES PH 2-3277

3415 W. BROADWAY COUNCIL BLUFFS, IOWA

ZYTRON "QUALITY BRAND"

RADIO & TV RECEIVING

TUBES

The Ideal Source of Supply for the Independent Service Dealer.

All Tubes Brand New, Individually Boxed, very Low Priced! Send TODAY for Catalog.

ZYTRON TUBE CORPORATION

220 West 42nd Street, New York 36, N. Y.

WHY WIRE IT? USE A DANCO

PRINTED CIRCUIT BOARD

Build a Hi-Fi Williamson type amplifier. There are no design problems. You save wiring time and eliminate the chances of errors. Mount your parts on the board as marked, make a few external connections, solder, and your amplifier is complete. Made of high quality phenolic board, with etched copper wiring securely bonded, the Danco Printed Circuit Board is pre-drilled ready to accept your components. Full instructions and tube sockets included. $4.95

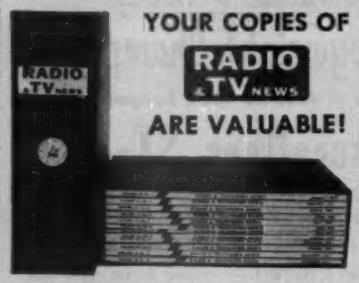
Preamp boards. Build your preamp exactly the way you want it. Layout and design assured—your choice of components—eliminate mistake—precision engineered—ease of construction—choice of combinations. Model 21 preamp equalizer, Model 31 input selector tone control stage. Model 41 gain compensator output stage, each $2.25

Each model of preamps includes full instructions and tube socket also.

DANCO MFG. CO., P. O. Box 533, Van Nuys, California

Sunspots Aid Radio Signals ..... 107 July
Tracking the Man-Made Satellite (Gunther) ..... 31 July

NEW AUTOMATION PUNCHED



YOUR COPIES OF RADIO & TV NEWS ARE VALUABLE!

Keep them neat . . . clean . . . ready for instant reference!

Now you can keep a year's copies of RADIO & TV NEWS in a rich-looking leatherette file that makes it easy to locate any issue for ready reference.

Specially designed for RADIO & TV NEWS, this handy file—with its distinctive, washable Kivar cover and 16-carat gold leaf lettering—not only looks good but keeps every issue neat, clean and orderly.

So don't risk tearing and soiling your copies of RADIO & TV NEWS—always a ready source of valuable information. Order several of these RADIO & TV NEWS volume files today. They are $2.50 each, postpaid—3 for $7.00, or 6 for $13.00. Satisfaction guaranteed, or your money back.

Order direct from:

JESSE JONES BOX CORP.
Dept. RN
Box 5120, Philadelphia 41, Pa.
(Established 1843)

GET INTO
ELECTRONICS

Valparaiso Tech trains for top flight positions. Technical representatives, field engineers, sales and specialists in communications, missiles, computers, radar, automation, color television. Basic and advanced theory and laboratory. Major companies visit school for our graduates. 21 months' course. High school graduate or equivalent. Dormitories—campus. Start February or September. G.I. approved. Write for catalog.

VALPARAISO TECHNICAL INSTITUTE
Dept. RD **Valparaiso, Indiana**

Service Industry and Public Relations (Leonard) ..... 58 Mar.
Strategy for C.O.D. Service (Margolis) ..... 162 Dec.
Time is Money (Leonard) ..... 46 Sept.
Upgrading and Accrediting Technicians (Zbar) ..... 56 Apr.
Up-to-Date Tube Inventory for Service Shops (Barlowe) ..... 67 Apr.
Why Service Associations? (Leonard) ..... 66 Oct.

GENERAL

CAREER OPPORTUNITIES

Behind the Giant Brains (Part 1) (Leary) ..... 37 Jan.
Behind the Giant Brains (Part 2)... (Leary) ..... 70 Feb.
Career Opportunities in Electronics (Buchsbaum) ..... 51 Sept.
Employment in the Computer Field (Bell) ..... 40 Sept.
Men We Hire (Graves) ..... 77 Sept.
"Univac"—An Electronic Brain for Industry ..... 41 Jan.

CONSTRUCTION PROJECTS

Build the "Transactivator" (Tooker) ..... 68 Nov.
Do it by Telephone—with a Phone Operated Switch (Diers) ..... 51 Nov.
Dry-Cell Battery Charger (Chernof) . 128 Oct.
Electronic Agitator—For Color Film Processing (Ross, Jr.) ..... 43 Feb.
Electronic Fencing "Touche" Indicator (Wortman) ..... 51 Dec.
FM and TV Sound Tuner (Morrissette) ..... 162 Nov.
Geiger Counter with Transistor Power Supply (Pugh, Jr.) ..... 35 June
"Lite-O-Tune" (McCready) ..... 47 Sept.
Medium Power Color Organ (Southworth) ..... 44 Oct.
Photoflash Synchronizer Checker (Gephart) ..... 68 Apr.
Photosensitive Meter Adapter (Brizendine, W4ATE) ..... 138 Nov.
Regulated Supply for Transistor Amplifiers (Lowry) ..... 55 Oct.
Solar Radio with Surface Barrier Transistor (Bohr) ..... 132 June
Subminiature Construction Techniques for the Home Builder (Garner, Jr.) ..... 72 Feb.
Transistor Bridge Oscillator (Belanger) ..... 118 Oct.
Transistorized D.C. Voltage Multiplier (Lederer) ..... 152 Nov.
Transistorized Marine Direction Finder (Read) ..... 42 June
Transistorized Pocket Superhet (Granoff) ..... 126 May
Transistorized Superhet ..... 148 Mar.
Transistorized Ultrasonic Generator (Garner, Jr.) ..... 43 May
TV-to-Radio Wireless Oscillator (Reed) ..... 150 Feb.

IGY

Bureau of Standards Role in IGY .. 41 Dec.
Earth Satellite's "Innards" Described ..... 76 Apr.
Electronics on the Hurricane Ship (Rosa) ..... 37 Oct.
First Guidance System for Satellite Rocket ..... 124 Feb.
IGY World Warning Agency ..... 100 July
Moon Radar Checks Minitrack .... 161 Oct.
Precision Steering at 18,000 M.P.H. (Berger) ..... 37 Sept.
Research at the Threshold of Space (Newell, Jr.) ..... 35 May
Satellite Magnetometer to Measure Earth's Field ..... 158 Sept.
Scientists Watch and Listen to the Sky ..... 108 Sept.
Signals from Jupiter Studied by N.B.S. ..... 100 Aug.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF RADIO & TV NEWS published Monthly at Chicago, Illinois for October 1, 1957.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Ziff-Davis Publishing Company, 64 E. Lake St., Chicago 1, Ill.; Editor, Oliver Read, 366 Madison Ave., N. Y. 17, N. Y.; Managing editor, William A. Stocklin, 366 Madison Ave., N. Y. 17, N. Y.; Business manager, G. E. Carney, 366 Madison Ave., N. Y. 17, N. Y.

2. The owner is: Ziff-Davis Publishing Co., 64 E. Lake St., Chicago 1, Ill.; Estate of William B. Ziff, 366 Madison Ave., N. Y. 17, N. Y.; A. M. Ziff, 366 Madison Ave., N. Y. 17, N. Y.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required from daily, weekly, semiweekly, and tri-weekly newspapers only.)

G. E. CARNEY, Business Manager.

Sworn to and subscribed before me this 27th day of September, 1957.
[SEAL] VICTOR C. STABILE, Notary Public.
(My commission expires March 30, 1959)

BE QUALITY WISE . . BUY QUAL-KITS!

HI-FI AMP. KIT
Complete 6 tube-10 watt amplifier. Push-pull beam power output, built-in pre-amp. 5 position selector switch. 3 position record equalization, LP, RIAA, Eur. Response ½ db. 20-20,000 cps. Output 10 watts at less than 2% IM. Low noise level and harmonic distortion. **$28.50**

Every kit complete with 28 page fully illustrated instruction and assembly manual. Cover and legs optional.

HI-FI AM-FM TUNER KIT
Advanced 7 tube circuit plus Rectifier for full sensitivity and selectivity. Distortion less than 1%. Sensitivity is 5 uv for 30 db quieting on FM, 25 uv AM. Armstrong FM Circuit with limiter Foster-Seeley Discriminator. 20-20,000 cps response. Full AFC control — no drift. Easy assembly. **$28.95**

Add 10% Fed. Tax

Write for FREE catalog and name of nearest dealer carrying these remarkable units.

QUALITY-ELECTRONICS
319 Church St. Dept. T-12 New York 13, N. Y.

Hi-Fi FM-AM TUNER
FAMOUS MAKE RCA LICENSED

SALE PRICE $37.95
1958 Model

Provides Endless Hours of Static-Free and Drift-Free FM Listening Pleasure.

Here is a complete HI-Fidelity FM-AM Tuner made by one of the top manufacturers. This is ideal for your custom installation. Audio Frequency response 20-20,000 cycles, ± 2db. 5-micro-volts sensitivity. Armstrong ratio detector circuit 2 volt audio output. Built in AM & FM antennas, phono jack and output jack for a tape recorder. RF Stage on FM. Can be plugged into any amplifier. Seven tubes and is self powered 105-120 V. AC, only. Ready to plug in. Factory wired and tested.

Size 12½"x8½"x7" High.
The perfect addition to your Hi-Fi system, TV set, phonograph or tape recorder!

Come in for free demonstration
Or send for yours today
Send for our low prices on the Hi-Fi components you require

BRAND NEW—GUARANTEED

Prompt attention given to mail orders. Send $10 on C.O.D. orders. A $5 dep. will reserve yours for XMAS.

UNITED AUDIO CENTER DEPT. RN
30 NORTH VAN BRUNT ST., ENGLEWOOD, N. J.
LO 6-1264—NEXT TO PLAZA THEATRE

SPRAY it or DROP it

HF-60—A New Power Amplifier .. 64 Apr.
High Power vs Low Power Amplifiers—Questions and Answers

ARROW MONTHLY SPECIAL!
12 V. MOBILE

Sunspots Aid Radio Signals.....107 July
Tracking the Man-Made Satellite (Gunther) ..... 31 July

MEDICAL ELECTRONICS
Electric Shock Used to Halt Heart Twitching .....101 May
Heart Microphone Monitors Murmurs .....123 July
Heart Recording..... 65 Nov.
Radio Pill Broadcasts from Stomach .....114 June
TV Cameras for Surgical Colorcasts .....121 Apr.

MISCELLANEOUS
Alaska Telephone Cable Opened for Use ..... 86 Mar.
Antenna Applications in Two-Way Radio Systems (McMullin)..... 37 Dec.
Atomichron—World's Most Accurate Clock ..... 63 Jan.
Birth of the Electron Tube Amplifier (Llewellyn) ..... 43 Mar.
Britain's National Radio Show....127 Nov.
Challenge to Civilian Inventors...156 May
Circuit Reliability (Penfield, Jr.)....114 Mar.
Electronic Service in Northern Mexico (Ives) ..... 50 Nov.
First Over-Horizon TV Bridge....128 Nov.
From Sun to Sound (Sheneman)... 42 Jan.
Fuel Cell Produces Electricity from Gases .....177 Dec.
Miniature Atomic-Powered Battery.160 May
New Home Warning Device Tested ..... 80 Apr.
1957 Parts Show Program.....132 May
Radiation Detector for Home Use. 136 Oct.
Standard Frequency Broadcast on 60 kc. .....118 Sept.
Subminiature Magnetic Amplifiers (Argabrite) ..... 70 Dec.
Summer Service: Room Air Conditioners (Derman) ..... 49 July
Transistor Terminology (Bukstein).. 68 Aug.
West Coast Hi-Fi Shows.....159 Feb.

MISSILES & MILITARY
B-52 Bomb-Navigation System....100 Feb.
Electronics at Redstone Arsenal.. 59 May
New Army Facsimile Set and Sun-Powered Helmet Radio.....136 Aug.
Radar Network for Air Traffic Control ..... 61 Feb.
Rubberized Circuits for Guided Missiles .....116 Feb.
Scatter System to Link NATO Nations .....104 Aug.
Super-Power SSB Army Transmitter .....117 July
Super-Radars for Missile Ship.... 37 July
Telemetry in Flight Testing (Part 1) (Downs) ..... 37 Nov.
Telemetry in Flight Testing (Part 2) (Downs) ..... 72 Dec.

TUBES & TRANSISTORS
Amazing Surface Barrier Transistor (Bohr) ..... 70 Aug.
Crystal Photocell Circuits (Ferres). 58 Jan.
Factors Determining Tube Life (Martin) .....111 July
Low Plate-Potential Tubes (Atkins). 47 Jan.
New Long-Life TV Rectifier..... 57 Mar.
Overworked Horizontal Amplifiers (Philpott) ..... 44 Aug.
"Spacistor" Combines Transistor and Tube Properties.....126 Oct.
Transistor Life Tests.....104 Jan.
20-Year Tubes for Transatlantic Cable .....146 May

HIGH-FIDELITY AUDIO

AMPLIFIERS
Additional Notes on "Professional Tape Recording Amplifier" (Johnson) .....103 Apr.
Compact 6 Watt Power Amplifier (Horton) ..... 62 Feb.

NEW AUTOMATION PUNCHED CARD TV TUBE TESTER

PROVED!

IN OVER 1 MILLION TUBE TESTS!

Model DM456
the original

Speed-test complete set of tubes in minutes with the new DynaMatic Tube Tester

- So simple to use—a customer can operate it!
- LIGHTEST and SMALLEST Gm tester available. Take it on ALL house calls.
- Perforated plastic cards set up socket pin connections and test voltages.
- Permits full-complement tube testing.
- DynaMatic is a dynamic mutual conductance tester—NOT an emission checker.
- Accurately measures mutual conductance in micromhos on 2 ranges. 0-6000, 0-18000.
- Also checks battery tubes.
- Needs only 58 Cards for complete testing.

Dealer Net 149.95
Prices slightly higher west of the Rockies

TELETEST INSTRUMENT CORP.

IMMEDIATE DELIVERY!

136-10 31st Road, Flushing 54, N. Y.

CANADA: WHITE RADIO LTD., 41 WEST AVE. NORTH, HAMILTON, ONTARIO
EXPORT: ROBURN AGENCIES, 431 GREENWICH ST. NEW YORK 13, N. Y.

Castle TV Tuner Service
1723 W. Lunt
Chicago 26, Ill.

ANY TUNER REBUILT
$9.95
(EXTRA IF MUTILATED)
152 MAIN ST.
TORONTO 13
in U.S.A. or CANADA

TV SERVICEMEN!
Write for SENSATIONAL CATALOG
HENSHAW RADIO SUPPLY
3619 TROOST KANSAS CITY, MO.

college grads get ahead faster!

. . . have higher incomes . . . advance more rapidly. Grasp your chance for a better life. Share rewards awaiting college men. Important firms visit campus regularly to employ Tri-State College graduates. Start any quarter. **Approved for Vets.**

Bach. Sc. degree in 27 months

Complete Radio Eng. courses (TV, UHF, FM, Electronics). Also Mech., Civil, Elec., Chem., Aero., Eng. **36-months in Bus. Adm.** (Gen. Bus., Acctg., Motor Transport Mgt.). Superior students faster. More professional class hours. Small classes. Enrollment limited to 1550. Beautiful campus. Well-equipped labs. Prep courses. Enter Jan., March, June, Sept. Earnest capable students (whose time and budget require accelerated courses and modest costs) are invited **to write Jean McCarthy, Dir. Adm., for Catalog and "Your Career in Engineering and Commerce."**

TRI-STATE COLLEGE
16127 College Avenue, Angola, Indiana

Wireless FM Microphone.....106 Apr.

PHONO
Buying a Tone Arm (Crowhurst)... 51 Jan.

CORO WORLD'S LARGEST MANUFACTURER OF

MODEL T-741

SPRAY it or DROP it

the NEW QUIETROLE Spray-Pack

or the QUIETROLE Bottle with the Eye Dropper Cap

New **QUIETROLE** offers you both types of containers. Either way assures you of the same unfailing results that **QUIETROLE** is known for.

Make your next purchase **QUIETROLE**, get both and learn the difference between quality and poor substitutes. **QUIETROLE** is the original product of its kind, it is a **FIRST** of the Industry and you can depend on it to end your noisy control and switch troubles.

manufactured by
QUIETROLE COMPANY
Spartanburg, South Carolina

GET INTO ONE OF THESE TOP OPPORTUNITY FIELDS

ELECTRICITY
– Electronics or
TELEVISION
– Radio-Color TV

TRAIN IN THE GREAT SHOPS OF

COYNE OLDEST, BEST EQUIPPED SCHOOL OF ITS KIND IN U. S.

Veterans and Non-Veterans—Prepare for a better job *NOW* that *offers a real future, too!* Get practical training in TELEVISION—RADIO—ELECTRICITY—ELECTRONICS—(Refrigeration & Electric Appliance Repair can be included). Learn on real equipment—no advanced education or previous experience needed. Lifetime employment service to graduates.

Finance Plan—enroll now, pay most of tuition later. Part time employment help to students.

FREE BOOK Clip coupon for Big Free Illustrated Book. No salesman will call. Act NOW.

B. W. COOKE, JR. President — **COYNE ELECTRICAL SCHOOL** — FOUNDED 1899

A TECHNICAL TRADE INSTITUTE OPERATED NOT FOR PROFIT
500 S. PAULINA St., CHICAGO, Dept. 97-85H
ELECTRICITY • TELEVISION • RADIO • REFRIGERATION • ELECTRONICS

B. W. COOKE, JR., Pres., COYNE ELECTRICAL School
500 S. Paulina St., Chicago 12, Ill., Dept. 97-85H
Send FREE BOOK and details on:
☐ TELEVISION-RADIO
☐ ELECTRICITY-ELECTRONICS

NAME.....

ADDRESS.....

CITY.....STATE.....

HF-60—A New Power Amplifier.. 64 Apr.
High Power vs Low Power Amplifiers—Questions and Answers (Crowhurst) ..... 49 Aug.
Negative Feedback Transistor Amplifiers (Lowry) ..... 55 May
New Master-Control Preamp..... 54 Jan.
"Peri-50" Power Amplifier.....142 Oct.
Portable Tape Recorder Amplifier (Pugh, Jr.) ..... 57 July
Preamp Kit Features Printed Circuits ..... 65 Dec.
Realistic High Fidelity—The Power That Drives the Speaker (Part 9) (Hartley) ..... 64 Jan.
Reducing Hum and Noise in Preamplifiers (Toby) .....159 Oct.
"SR-200" Hi-Fi Control Amplifier (Rayment) ..... 49 June
3-Channel Amplifier (Betsh)..... 65 Mar.
Transistor Mike Preamps (Fenfield, Jr.) ..... 50 May

CIRCUITS

Improving the Cross-Coupled Inverter (Pryor) .....112 Oct.
In Defense of the Split-Load Phase Inverter (Peters) .....182 Nov.
Measuring Amplifier Damping Factor ..... 92 June
New Look at Positive Current Feedback (Zink & Sanford)..... 56 Nov.
Phase Inverters for Hi-Fi Amplifiers (Horowitz) ..... 92 May
Plug-In "Presence" Equalizer (Ferres) ..... 42 Feb.
Realistic High-Fidelity—Audio Output Tubes and Circuits (Part 10) (Hartley) ..... 51 Feb.
RIAA Equalization for Early Preamps (Keidel) .....114 Dec.
Simplified Automatic Tone Compensator (Miller) ..... 67 Feb.
Why Loudness Control? (Crowhurst) ..... 42 Apr.

GENERAL

All About Audio and Hi-Fi—The Listening Ear (Part 1) (Briggs).. 40 May
All About Audio and Hi-Fi—Room Effects (Part 2) (Briggs)..... 38 June
Choosing Your Crossovers (Crowhurst) ..... 51 Oct.
Power Requirements for Hi-Fi (Hafler) ..... 44 Jan.
Why Do Amplifiers Sound Different? (Crowhurst) ..... 40 Mar.

MISCELLANEOUS

Adding an FM Tuning Indicator (Burstein) ..... 59 Mar.
Before You Call for Service—Check Your Own Hi-Fi System (Philbrook) ..... 35 Mar.
Cover Story ..... 95 Mar.
Electronics at the L.A. County Fair (Burdette) ..... 70 Sept.
Hi-Fi for Hyer..... 92 Aug.
Mobile High Fidelity (Waddill, Jr.) .....116 Aug.
Sea-Going Hi-Fi (Carrington)..... 42 July
This Month's Cover..... 43 July
This Month's Cover..... 71 Sept.
Transistorized Intercom (Maloney) ..... 54 Aug.
Transistor Intercom System (Palmer) ..... 94 July

NEW DEVELOPMENTS

Diamond Needles Produced Automatically .....105 Sept.
FM "Musicasting"—A New Industry (Hershfield) ..... 128 June
Progress in FM Multiplexing (Burstein) .....107 Mar.
SSB Broadcasts Promise Hi-Fi..... 127 Aug.
Transistorized FM Wireless Microphone (Garner, Jr.)..... 45 July

ARROW MONTHLY SPECIAL!
12 V. MOBILE . . .
12 V. MARINE . . .
Here is your Dynamotor!
12/14 V., 2.4 A. Output 250 V., 60 ma conservative, 80 ma easy! Plugs on rear of all Command Receivers. Pin 1 common, 2 LV, 3 HV. BRAND NEW! Ship. wt. 5 lbs. Cat. 306DN25. **$2.95**
Steal it for only
MARINE MANUFACTURERS
We have large quantity available. Write us for a good deal!

DON'T BUY A THING—
until you send for our
CATALOG 116!
DON'T SELL A THING—

until you offer it to us!
We will pay $$$$.¢¢ for an AN/ARN-6 or AN/ARC-3 or any of their components.
Also for AS-313 LOOP
SIMILAR FABULOUS PRICES PAID:
APS-6 . . . ARC-1
ARN-7 . . . ANT-13 PARTS
. . . BC-788-C . . . I-152-C
. . . LP-21-AM, -LM, or MD-18A or MC-507 from these loops . . . R-65/APN-9 TEST SETS 1-100, TS-117, -128, -147, -148, -488. What else have you? ? ?

ARROW SALES, INC.
Western Mailing Address:
Box 3007-R NORTH HOLLYWOOD, CALIF.
Central Mailing Address & Sales-Showroom:
2534 S. MICH. AV., Dept. R., CHICAGO 16, ILL.
California Distributors' Stores
G. L. Electronics, Inc., 1632 Venice, Los Angeles
P.A.R.T.S., 8905 San Fernando Rd., Sun Valley

SCHEMATICS—CONVERSIONS FOR SURPLUS GEAR
NEW LIST D! MANY ADDITIONS!
Send stamped, self addressed envelope for List D. Add 25¢ for chart explaining AN nomenclature. DO IT TODAY!
R. E. GOODHEART — BOX 1220 BEVERLY HILLS, CAL.

a TERRIFIC BARGAIN in a
SOLA CONSTANT-VOLTAGE TRANSFORMER
Ends fluctuating line voltage!

Big Discount Off . . .
the factory price at a 1-input 2,000 VA unit! And here's another bonus! This Air Forces 2,000 VA ever-stock, Sola Cat. No. 30768, has 4 inputs! 90-125 V., 190-250 V., 50 cy. or 50 cy. Isolated secondary is constant 115.0 V. ± 1% from no-load to full-load of 17.4 amp. So, if you choose, use it as a 230:115 V. step-down. And slash $97.50 off the factory 1-input price!
Brand new in original wood box. 4 cu. ft. Ship. wt. 254 lbs. F.O.B. Pasco, Wash. Only.....
$147.50
THE M. R. COMPANY
P. O. Box 1220-A Beverly Hills, Calif.

You can reach the world's largest audience of semi-technical readers through the Classified Section of RADIO & TV NEWS
For details and rates, write to:
Martin Lincoln
Classified Advertising Manager
Ziff-Davis Publishing Company
366 Madison Avenue
New York 17, N. Y.

Best Value of the Year!

Motorola Color TV Receivers (Gary) ..... 46 June

CROWN

Wireless FM Microphone..... 106 Apr.

PHONO

Buying a Tone Arm (Crowhurst)... 51 Jan.
"Dynetic"—A New Cartridge and Tone Arm (Crowhurst)..... 49 May
Electronic Turntable Drive..... 42 Sept.
New Hi-Fi Reluctance Phono Cartridge (Daily)..... 66 Dec.
Rumble Filters for Hi-Fi Systems (Petrie) ..... 42 Aug.
Turntable Speed Problems (Garrett) ..... 46 Mar.

RECORDING

Off-The-Air Tape Recording—Tape Your Favorite Programs (Garner, Jr.) ..... 46 Oct.
Tape Recorder Bias-Erase Oscillators (Reed) ..... 58 Sept.
Tape Recorder Quiz (Burstein).... 64 Nov.

SPEAKERS-HOUSINGS

All About Audio and Hi-Fi—Testing Loudspeakers (Part 4) (Briggs) ..... 40 Aug.
All About Audio and Hi-Fi—Checking Speaker Performance (Part 5) (Briggs) ..... 66 Sept.
All About Audio and Hi-Fi—Electrostatic Speakers & Transient Response (Part 6) (Briggs)..... 63 Oct.
All About Audio and Hi-Fi—Transients and Directional Effects (Part 7). (Briggs)..... 60 Dec.
Balcony or Orchestra—which Loudspeaker? (Bernheim) ..... 44 Feb.
Electronic Crossovers for Hi-Fi (Keidel) ..... 54 July
Electronic System for 2-Way Speaker Operation (Vaughn)... 50 Jan.
Ionic Cloud High-Freq. Speaker.. 105 Apr.
Ionic Cloud Tweeter Demonstrated. 102 May
Loudspeaker Damping and Tonal Response (Augspurger) ..... 62 Mar.
New Hi-Fi Speaker System..... 54 Apr.
New Hi-Fi Speaker System—Features Unique Design Principles (Crowhurst) ..... 58 Oct.
Power Ratings for P.A. Driver Units (Epstein) ..... 38 July
Reverberation Unit for Hi-Fi Reproduction—The "Xophonic" ..... 56 June
Speaker Damping with Series Resistor ..... 60 May
"Tiny Mite" Loudspeaker Enclosure (Cohen) ..... 52 Mar.
"Ultraflex" Speaker Enclosure (Snitzer) ..... 58 Aug.
Why Low-Efficiency Speaker Systems? (Villchur) ..... 44 Nov.

STEREOPHONIC

All About Audio and Hi-Fi—Room Resonance and Stereo (Part 3) (Briggs) ..... 34 July
Coded Stereo for Hi-Fi—Questions and Answers (Crowhurst)..... 60 June
Stereo Balance and Gain Control (Burstein & Pollak)..... 42 Dec.

TELEVISION

ANTENNAS

Diplexer Two-Set Coupler (Harris) ..... 69 Sept.
Three Antennas on One Lead (Woodard) ..... 48 Dec.

COLOR

Design Features of Packard-Bell Color Sets (Buchsbaum)..... 66 Aug.
G-E's Large-Screen Color Sets (Gary) ..... 53 Apr.
Mac's Service Shop (Frye)..... 70 June
Mac's Service Shop (Frye)..... 67 July

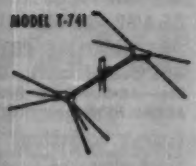
TENNA
FORMERLY RADELCO

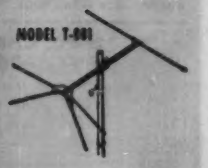
WORLD'S LARGEST MANUFACTURER OF ANTENNAS PRESENTS

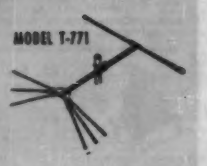
America's Finest LINE OF *Conicals*

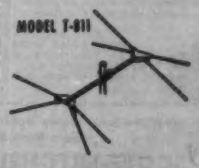
with "PRESTO" INSTANT MOUNT ASSEMBLY

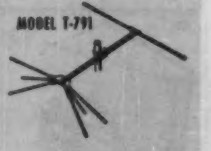
THAT OPENS AS EASILY AS AN UMBRELLA!







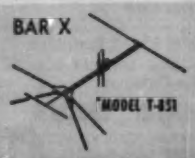


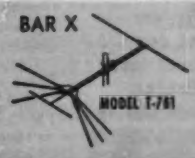


COMPARE TENNA FEATURES!

● Arrays are full size and completely pre-assembled ● New Polyethylene Cable Anchor removes all tension from terminals ● Front Bracket made of heavy spring temper aluminum alloy with High Q molded plastic insulator ● Rear Bracket made of heavy gauge aluminum to resist strongest gales and heaviest ice ● Doweled elements prevent whistling ● Director Bar on Bar-X models improves performance on higher channels ● Full line: 8 single array models, 8 stacked models and 8 "Do-it-yourself" models.

THE TENNA MANUFACTURING CO.
CLEVELAND 25, OHIO





ALL MODELS AVAILABLE SINGLE OR STACKED IN INDIVIDUAL BOXES OR IN BULK

TV SERVICEMEN!
Write for SENSATIONAL CATALOG
HENSHAW RADIO SUPPLY
3619 TROOST KANSAS CITY, MO.

ENGINEERING DEGREES
E.E. OPTION ELECTRONICS
Under and Postgraduate
Earned through Home Study
Residence classes also available
(Operating as a College of Engineering only at present)
PACIFIC INTERNATIONAL UNIVERSITY
5719J Santa Monica Blvd.
Hollywood 38, California

30 Watt Hi-Fi Super Lin Kit
AMP-PREAMP with TRANSISTORIZED FRONT END

FREQUENCY RESPONSE: ± 1 db 10-40,000 cps. TUBES: uses (1) 6AU6, (1) 12AT7, (1) 12AU7, (2) EL34's, (1) 5V4-GB. SHIPPING WEIGHT 26 lbs. FL-30 Sale Price.. **$42.00** F.O.B. N.Y.

12 Watt Williamson TYPE AMP. KIT—15-40,000 CPS. Only $26.95

NEW GENERAL ELECTRIC
4-GRAM Variable Reluctance Cartridge 1-Mil-Diamond 3-Mil-Sapphire #40-052 $16.39. Dual Sapphire Cartridge **$6.50**

NEWEST MODEL MONARCH 4 SPEED CHANGER
4-pole motor, intermix, manual player position, automatic shut-off. British-made. Complete with Ceramic dual sapphire stylt cart. Base for above—$3.50; 45 spindle—$2.39..... **$22.95**

Send for Free Catalogue. Low, Low Prices on All Hi-Fi Units

CUTICK ELECTRONICS HI-FI RADIO T.V. PARTS
171 Washington St., WOrth 2-9866, New York 7, N.Y.

TV Sound Can Be Improved (Bramham) ..... 44 July
Unusual TV Circuit Troubles

LEKTRON'S BIGGEST-EVER CHRISTMAS
DOUBLE BONUS OFFER!

Best Value of the Year!

2½ AMP. RUGGED DUTY

¼" THOR SPEEDRILL

with Geared Chuck and Key—AC-DC—2400 RPM

BRAND NEW! OUR PRICE $14.95 plus 50c pp. & hdlg.

If your work calls for a "rugged" drill with POWER TO SPARE, insist on a 2½ Amp. job . . . and make sure it's THOR! No finer drill made! Solid steel, heat treated helical gears; thrust taken on hardened steel ball and plate; gears permanently packed and sealed in LIFETIME grease! Switch, trigger and lock assembly simplifies locking and releasing trigger. You'll be wise to buy 2 at this price. Supplies limited!

29-PC. CHROME VANADIUM DRILL SET

Specially made for speed drilling. In sturdy plastic tool roll. Finest alloy steel drills hardened and precision ground to the sharpest, longest lasting cutting edge obtainable; will easily and cleanly bite through hardwoods, plastics, aluminum, iron and the toughest steels. Unconditionally guaranteed for thousands of drillings. Full jobber length. Sizes by 64ths from 1/16" to 1/4". There are only a limited quantity of these imported German sets available at this low price, so hurry!

NOW.....ppd. **$6.49**

Also available with Turned Down Shanks to fit all ¼" drills. In individual pocket roll..ppd. **$8.95**

60 Pc. Set Wire Gauge CHROME VANADIUM DRILLS

Top quality German import, high test Chrome Vanadium Drills designed for speed drilling through toughest steels, woods, plastic, iron and aluminum. Precision ground long-lasting cutting edges. Guaranteed to give years of satisfaction. A full 60 pc. set. Nos. 1 thru 60.

A $14.95 Value. Now Only.....$5.40

plus 35¢ pp. and hdlg.

Same set above available with Rust Metal Index container. Only.....**$6.65**

plus 35¢ pp. and hdlg.

Also Available—20-PC. SET NOS. 61-80 WIRE GAUGE DRILLS

Finest steel! Tops for precision work in woods, plastic, iron, aluminum, etc. Includes plastic kit with marked pocket for each drill.

Only.....ppd. **$2.50**

Send check or money order. If C.O.D., fees extra.

Money-Back Guarantee.

SCOTT-MITCHELL HOUSE, Inc.

Dept. M-491, 611 Broadway, New York 12, N. Y.

FIX OLD RADIOS IN A JIFFY!

Fix 'em good as new . . . without lost time or needless testing

Often it takes more time than it's worth to fix old radios . . . but NOT when you own this 3½ pound, 744-page Ghirardi RADIO TROUBLESHOOTER'S HANDBOOK! **The only service guide of its kind still in print!** Gives common trouble symptoms and remedies for over 4,800 old-time receiver models made by 282 manufacturers prior to 1943—also auto radios. Even beginners can use it to repair old sets that might otherwise be thrown away because service data is lacking or because testing takes too long.

CUTS SERVICE TIME IN HALF

This famous Handbook more than pays for itself the first time you use it. Covers 85% of the things that are apt to go wrong. Shows exactly where the trouble is likely to be. Explains step by step how to fix it without lost time or useless testing.

Gives full service details on old sets made by Airline, Apex, Arvin, Atwater Kent, Belmont, Bosch, Brunswick, Clarion, Crosley, Emerson, Fada, G-E, Kolster, Majestic, Motorola, Philco, Pilot, RCA, Silvertone, Sparton, Stromberg and dozens more. Includes hundreds of pages of old tube, transformer and other component data.

10 DAY FREE EXAMINATION

Dept. RN-271, RINEHART & CO., Inc.
232 Madison Avenue, New York 16, N. Y.

Send RADIO TROUBLESHOOTERS' HANDBOOK for 10-day examination. If I decide to keep book, I will then send $6.95 plus postage. Otherwise, I will return book promptly and owe you nothing.
(SAVE! Send $6.95 with order and we pay postage. Same 10-day return privilege with money refunded.)

Name .....

Address .....

City, Zone, State .....

OUTSIDE U.S.A.—Price $7.95 cash with order only. Money back if you return book in 10 days.

Motorola Color TV Receivers (Gary) ..... 46 June
New Circuits in G-E Color Sets (Buchsbaum) ..... 66 May
Packard-Bell Color TV Line (Buchsbaum) ..... 61 July
Practical Color TV for the Technician (Part 1) (Kleidon)..... 57 Aug.
Practical Color TV for the Technician (Part 2) (Kleidon)..... 62 Sept.
Practical Color TV for the Technician (Part 3) (Kleidon)..... 67 Oct.
Practical Color TV for the Technician (Part 4) (Kleidon)..... 48 Nov.
Strategy of Color Servicing (Margolis) ..... 40 Feb.
Sylvania Color TV Circuits (Buchsbaum) ..... 54 Feb.
Sylvania's New Color TV Line (Buchsbaum) ..... 46 Jan.
Westinghouse Color Circuits (Buchsbaum) ..... 58 Dec.

MISCELLANEOUS

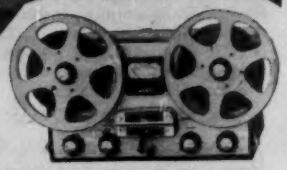
Are Your Electrolytics Leaky? (Crisses & Gnessin)..... 42 Mar.
Bottlenecks in TV Service (Ledbetter) ..... 40 Apr.
Electronic Service in Northern Mexico (Ives) ..... 50 Nov.
First 21" 110-Degree CRT.....116 June
Functional Work Bench (McCallum) ..... 51 Apr.
Industrial TV Control System..... 94 Feb.
Measuring Capacitor Resistance (Marcus) .....134 Sept.
Pictures on a Flat Panel? ..... 55 Sept.
"Pure Signal" CRT Eliminates TV Stage .....121 June
Repairing Shorts in Vacuum Tubes (Herman) .....120 June
Save That Capacitor (Jones).....111 Mar.
Sunspots Mar TV Reception (Silver) ..... 98 Aug.
Temperature Tests in Radio-TV Troubleshooting (Middleton) .... 45 June
Two TV Programs on One Channel 105 Dec.
War Against Interference..... 36 July
What's Ahead for the TV Industry. 94 Jan.
Wobbled Scanning with a New CRT ..... 52 Aug.

SERVICE NOTES

Bench Puzzlers (McRoberts).....130 Feb.
Curing TV I.F. Troubles (Quaranta) .....110 Feb.
Design Features of 9" G-E Portables (Najork) ..... 57 Jan.
Facing the Phase Detector (Eldridge) ..... 70 Apr.
FM Converter for Intercarrier TV (Morrissette) .....108 July
Handling FM-to-TV Interference (Philpott) .....112 Jan.
"Hi-Fi" Video Output Stages (Cohn) .....112 June
Hot Chassis Hazards..... 41 Oct.
Mac's Service Shop (Frye)..... 70 Mar.
Mac's Service Shop (Frye)..... 70 May
Mac's Service Shop (Frye)..... 72 Sept.
Mac's Service Shop (Frye)..... 75 Nov.
Muntz TV Hints (Hunholz).....120 Mar.
'56 G-E TV; Many Symptoms—One Cause (Hust) .....145 Feb.
Nose for Servicing (Savigny)..... 48 July
Parasitics in Vertical Output (McRoberts) .....121 Aug.
Portable with the 110° CRT (Swaine & Schuster)..... 62 May
Problems in Metropolitan TV Reception (Holzman) ..... 38 Mar.
Service Notes .....193 Nov.
Service Techniques for Standard Coil Tuners (Garrett)..... 46 Nov.
Toying with TV Design (Eldridge). 62 Nov.
Tracking Externally Caused Hum (McRoberts) ..... 42 Oct.
TV Remote Control for the Technician (Buchsbaum) ..... 58 Nov.

CROWN

Professional Tape Recorder



NOW!

CROWN IMPERIAL

with all its proven standards: Regular half track record and play with 20 watts hi-fi output on 1st channel

PLUS In-line Stereo playback with cathode follower output on 2nd channel

The Finest Stereo in the Industry!

Only **$535** With Case

Write for literature
Address Dept. RN-12

Standard and Stereo models

INTERNATIONAL RADIO & ELECTRONICS CORP.
ELKHART, INDIANA

HAVE YOU HEARD ABOUT THE NEEDLE THAT REMEMBERS? WRITE:

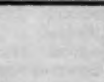
DUOTONE CO., INC.
Keyport, New Jersey
In Canada,
Charles W. Pointon, Ltd., Toronto
The Originator of the First Commercial Diamond Needle

110V, AC POWER SUPPLY FOR 274N RECEIVERS

Just plug it into the rear of your 274-N RECEIVER . . . any model. Complete kit and black metal case, with ALL parts and diagrams. Simple and easy to build in a jiffy. Delivers 24 volts plus B voltage. No wiring changes to be made. Designed especially for the 274-N receiver. **Only $8.95.**

Filament trans. for 274N receivers. Pri. 110V, 60 cy. AC. Sec. 24V @ .6A. An excellent buy at .....**$1.95 ea.**

SPLINED TUNING KNOB FOR 274N RECEIVERS



An exclusive O-R item manufactured for us. Fits BC-453, BC-454 and other 274N receivers. This is a really hard-to-obtain item. Only..**89c ea.**

OFFENBACH-REIMUS

1564 Market Street, San Francisco, Calif.

The ALL NEW "20-POUNDER"

All About Audio

ON SALE NOW!

TV Sound Can Be Improved (Bramham) ..... 44 July
Unusual TV Circuit Troubles (Blitzer) .....118 Mar.

TEST EQUIPMENT

AMATEUR

Miniature Scope for the Hamshack (Wagner, W6WGD) ..... 68 Feb.
Sensitive R.F. Power Monitor (Gottlieb, W6HDM)..... 57 Dec.
Wide-Range Crystal Marker Generator (Pollack) ..... 68 Dec.

AM-FM

Accurate Voltage Divider (Bohr)... 68 May
Audio Frequency Sweep Generator (Graham) ..... 63 Aug.
"Dyna-Box" Doublechecks Tube Tester (Roberts) ..... 64 June
Electrometer—A Very High Input Resistance V.T.V.M. (Shankland). 67 Jan.
Get Sweep from Your Signal Generator (Yao) ..... 47 Dec.
Improving V.T.V.M. Linearity (Schmidt) .....138 May
Mac's Service Shop (Frye)..... 72 Oct.
Maintain and Repair Your Own Signal Generator (Buchsbaum).. 60 Oct.
Maintain and Repair Your Own Sweep Generator (Buchsbaum).. 53 June
More Jobs for the A.C. V.T.V.M. (Turner) ..... 69 Mar.
Multi-Purpose Tone Generator (Diers) .....120 July
Portable Thyratron Tester (Philbrook) ..... 46 Feb.
Practical Techniques of Square-Wave Testing (Louis)..... 64 July
"Signal Finder" (Dunscombe)..... 44 Sept.
Sine-Wave Clipper (Shattuck)..... 45 Aug.
Transistor Current-Gain Test Set (Todd) ..... 54 Mar.
Tube Tester Modernization (Wynnick) ..... 65 May
Two-Terminal Test Oscillator (Leonard, Bob) ..... 61 Apr.

MISCELLANEOUS

Questions and Answers on Oscilloscopes (Middleton) ..... 58 Apr.
Substitution Jigs Speed Service (Van Sutphin) ..... 49 Oct.
Test Leads and Cables (Gary)....136 July

NEW TUBE TESTER DATA

Allied (Knight); Nov., 168...Elco; Feb. 98 ...EMC; April, 74, Aug., 102...Jackson; Jan., 95, April, 74, Sept., 144...Philco; Feb., 98, Sept., 144...Simpson; May, 116, Dec., 142...Triplett; March, 152, June, 122, Oct., 171...Weston; July, 96.

TELEVISION

Case for the CRT Tester-Reactivator (Margolis) ..... 48 Apr.
Choosing a Color-Bar Generator (Stamiti) ..... 62 July
Field Strength Meter that Tests Tuners (Middleton) ..... 56 Feb.
Low-Cost Scanning Generator (Dorst) ..... 68 Jan.
Monitoring Short-Term Intermittents (McRoberts) .....108 June
New Transistorized Voltmeter (Malamud) ..... 66 Nov.
Pocket CRT Checker (Jones)..... 63 June
Portable 90-Degree Test CRT (Jans) ..... 49 Feb.
Practical Color TV for the Technician (Part 5), (Kleidon)..... 62 Dec.
Test Equipment for Color TV Shops (Buchsbaum) ..... 45 Apr.
Transistorized TV Bar Generator (Knight) ..... 48 Sept.
Use Your Scope Daily (Bramham). 55 Nov.
V.H.F. Field-Strength Meter Adapter (Brizendine, W4ATE)... 71 Jan.

-30-

LEKTRON'S BIGGEST-EVER CHRISTMAS

DOUBLE BONUS OFFER!

Our annual "Thank You" to our thousands of customers

FREE WITH EVERY $10 ORDER

NOTE: This offer good only until DEC. 25th in the U. S. (Foreign orders until JAN. 25th.)

BONUS #1 Your Choice of ANY $1 KIT FREE! + BONUS #2 $15 worth of RADIO PARTS FREE! = DOUBLE BONUS Sixteen Dollars worth of parts free with $10 order!

WORLD FAMOUS KIT KING DOLLAR BUYS!

☐ HOBBY METER. 2½" rd. Bakelite panel meter, 0 to 32 VDC. Reg. $6. $1

☐ 60 TRANSFORMERS, COILS. Reg. $15. IF, RF, ant., slug-tuned coils, chokes. 25 types. Wt. 3 lbs. $1

☐ VREDER-ROOT COUNTER. 000-999. Ideal for all counting operations. Reg. $4.99. $1

☐ 3 LBS. HARDWARE. Reg. $6. Approx. 2000 pcs. Asstd. screws, brackets, etc. $1

☐ 2 TRANSISTOR TRANSFORMERS. UTC "ouncer" type. Reg. $10. Interstage, 1x4x3x3/4". Impedance unknowns. Color-coded leads. $1

☐ EMERSON TUNER. Hi-Q, permeability-tuned ANT & OSC coils w/padders on 2x4" plate; variable tuning mech. Reg. $5. $1

☐ 25 MERCURY SWITCHES, for silent switching; glass sealed w/mercury, leads. 115 V. Reg. $6. $1

☐ WORLD'S SMALLEST RADIO KIT. 2½x1¾x¾" w/permeability tuner, diode, all parts, directions. Reg. $3.50. $1

☐ 275-Ft. HOOKUP WIRE. Reg. $3.75. In 25-ft. rolls. Asstd. colors, stranding, insulation. #18 to #24. Wt. 2 lbs. $1

☐ 6 RAYTHEON GERMANIUM DIODES. Type CK-705; like 1N34, 1N34A, 1N48, 1N51, 1N69, & 1N66. Reg. 85¢ each. $1

☐ "Postagestamp" CRYSTAL MIKE. ⅝" sq. Crisp, clear to 8,000 cps. $1

☐ 2 SUB-MINI SOLENOIDS. 1 x ⅝ x ⅝". Change elec. energy to mechanical. 12 VDC @ 300 ma actuates plunger. Wt. 2 oz. Reg. $5. $1

☐ 60 RESISTORS. Insulated. Many 1% & 5%. ½ to 2 W; 10 ohms to 10 megs. 30 values. Wt. ½ lb. Reg. $16. $1

☐ SUB-MINI P-N-P TRANSISTOR. ¼ pencil eraser size. Used in "name" portables. W/spec sheets. $5 value! $1

☐ 10 3-SEC. TIMING MECHANISMS. Reg. $3 each! Multi-geared for all kinds of gadgets. Wt. 2 lbs. $1

☐ 4 MINIATURE RECTIFIERS. ½-wave. selenium. Reg. $1 each! $1

☐ 60 TUBULAR CONDENSERS. .0002 to .1 mf., to 2000 V. Oils & mica, incl. Wt. 2 lbs. Reg. $12. $1

☐ 60 PORCELAINIZED RESISTORS. Carbofilm, precision-type. 25 values: ½ to 1 W, 56 ohms to 1 meg. Reg. $12. $1

☐ 30 TUBE SOCKETS. Transistor, printed circuit. 4-14 prong: mini, standard types. Some mica filled. Wt. 1 lb. Reg. $8. $1

☐ SIX .DIODES. Asstd. sizes, crystal and silicon. Reg. $12. $1

☐ 8 TRANSISTOR SOCKETS. Mica-filled. For sub-mini tubes, too. Reg. $3. $1

☐ 40 PRECISION RESISTORS. Carbofilm, Wilkors, etc. 1% to 1 W asstd. Wt. ½ lb. Reg. $18. $1

☐ 40 MOLDED CONDENSERS. Black Beauties, porcelain, etc. Reg. $6. To .1 mf to 1000 V. Oils incl. Wt. 1 lb. $1

☐ 75-PC. RESISTOR SPECIAL! All types asstd.: power, carbon, transistor, precision. 50 values— WORTH $15. Wt. 1 lb. $1

☐ 40 TRANSISTOR RESISTORS. Only ¼" long. 20 values; 15 ohms to 10 megs. Color-coded. Reg. $6. $1

☐ 6-PC. NUTDRIVER SET. Plastic handle. 3/16, 7/32, ¼, 5/16, 11/32, ⅜, 7/16" steel socket wrenches in plastic case. Wt. 1 lb. $5 value. $1

☐ 100 RADIO PARTS. Surprise asstmt. Reg. value over $15. Wt. 3 lbs. $1

☐ 4 OUTPUT TRANSFORMERS. 50L6, 35L6, 6V6, 50B4 to 3-4 ohm v.c. Wt. 1 lb. Reg. $6.50. $1

☐ 30 PRINTED CIRCUIT PARTS, BOARDS. Wide variety, exclusive! Reg. $17. Wt. 1 lb. $1

☐ 15-PC. TWIST DRILL SET. 1/16 thru ¼" x 64ths, in graduated plastic holders. Reg. $4. $1

☐ 60 TERMINAL STRIPS, POSTS. Wide variety solder lug, binding, etc. Wt. 1 lb. $1

☐ 15 ROTARY SWITCHES. Ceramic & bakelite; 1, 2, 3-gangs. Std. shafts. Wt. 3 lbs. Reg. $14. $1

☐ 30 DISC CONDENSERS. Transistor & printed circuit types. Reg. $8. $1

☐ 50 STANDARD KNOBS. Bakelite & plastic in assorted colors. Set-screw types incl. Wt. 2 lbs. Reg. $9. $1

☐ 50 PLUGS & RECEPTACLES. Audio, power, chassis, panel & aptr. types. Wt. 2 lbs. $1

☐ 60 MICA CONDENSERS. Silver. 5% incl. 30 values: .00001 to .01 mf. To 1000V. Wt. 1 lb. Reg. $5. $1

☐ 10 ELECTROLYTICS. Asstd. can, tubular types to 500 mf. Wt. 3 lbs. Reg. $14. $1

☐ 30 POWER RESISTORS. WW, candohm, sand-coated, vitreous. 15 values: 5 to 50 W 35 to 11000 ohms. Wt. 2 lbs. $1

☐ 100 CERAMIC CONDENSERS. Asstd. types, color-coded. Discs, too. Reg. $15. $1

☐ 15 VOLUME CONTROLS. Reg. $10. Singles and duals to 1 meg. Wt. 1 lb. $1

☐ 10 "POLY" BOXES. Asstd. sizes: clear plastic, hinged, w/snap locks. Reg. $2.50. $1

☐ 65-PC. CONDENSER SPECIAL! All types asstd.: molded, oil, ceramic, paper, mica, variable, discs. Reg. $15. Wt. 2 lbs. $1

☐ 5 FERRI-LOOPSTICK CORES. Hi-Q, asstd. flat & tubular, 5 to 7" long. Wt. 1¼ lbs. $1

☐ 125 RESISTORS. ½, 1 W. 40 values: 5 ohms to 10 megs. 5%, too. Reg. $15. $1

SANTA CLAUS SPECIALS!

SUPER SOLAR BATTERY

☐ REG. $10. Generates greater energy than famed B2M! 2½x1⅝x½" plug-in type, in handy case $2.88

TRANSISTOR PORTABLE RADIO KIT with speaker

☐ No experience necessary! Famous make kit, with powerful Hi-Q ferrite antenna, diode det., 2 transistor ampl. stages, 4" spkr. 7¼x5x2½" styrene case. For broadcast band. Instructions, diagrams, pictorials, all parts $12.94
☐ 9V battery, 69¢ extra.

HEARING AID PHONES w/cord

☐ Crystal $1.39
☐ Dynamic—5,000 ohm $1.69

HI-FI TWEETER

Metal cased, cone. Freq. response, 3,000 to 16,000 cps. Max. rating, 20 W. 3⅞x2½ w/flat surface mtg. bracket. Elsewhere, $5.95 to $12. TWO TYPES: ☐ 8 ohm, ☐ 16 ohm imp. each $3.99

CROSSOVER NETWORK

☐ Crossover freq. 2500 to 3500 cps. For 8 and 16 ohm v.c. to match above tweeter. Reg. $14. only $6.99

3-TUBE AC-DC AMPLIFIER

☐ Fully wired. Reg. $5. Sep. vol., tone controls. Lowest price ever! $2.99
☐ TUBES, $1.91 extra.

"SLIM JIM" CRYSTAL MIKE

☐ 60 to 10,000 cps. Sleek, lightweight aluminum; 4⅝x1½" dia. (N-OFF sw., cable, conn. Ship. wt. 2 lbs. Reg. $14.95. $4.88

POCKET MULTI-TESTER

☐ 3½x2x1¼" bakelite case. 100 ohms/V. Zero adj. 0/15/150/1000 AC & DC V; 0/150 ma; 0/100,000 ohms. W/test leads in orig. pack. $13 value! $6.99

AMAZING "PILLOW" SPEAKER

☐ "Silent-sound" by bone conduction to inner ear. 3Ω ohm v.c. 100% personal listening. Complete w/cord $2.88

12" HI-FI SPEAKER

☐ 50 to 10,000 cps. Use w/tweeter as nifty coax. 3 to 4 ohm v.c. ..... only $4.44

SCOOP! SOLDERING GUN

☐ Lightweight, controlled heat for transistor & printed circuit work $4.99

FREE! GIANT 12-PAGE CHRISTMAS FLYER!

HOW TO ORDER

Check items wanted, return entire ad w/ check or MO, including sufficient postage, excess returned. C.O.D. orders 25% down. Rated, net 30 days. Print name, address, amount money enclosed, in margin. (Canada postage, 45¢ 1st lb.; 28¢ ea. add'l lb.)

LEKTRON

EXPORT ORDERS INVITED 133 EVERETT AVE. CHELSEA 50, MASS.

BARGAIN HUNTING? TV SERVICEMEN! Write for SENSATIONAL CATALOG HENSHAW RADIO SUPPLY 3619 TROOST KANSAS CITY, MO.

TAPE RECORDERS
WHOLESALE PRICES
HI-FI COMPONENTS
NATIONAL BRANDS
WRITE FOR FREE CATALOGUE
CARSTON 215-RD E. 88 ST. NEW YORK 28, N. Y.

ENGINEERING

B.S. DEGREE IN 27 MONTHS

Prepare for unlimited opportunities of the Electronic Age! Earn your B.S. DEGREE IN 27 MONTHS in Aeronautical, Chemical, Civil, Electrical or Mechanical Engineering; in 36 MONTHS in Mathematics, Chemistry, Physics. Intensive, specialized courses. Comprehensive training in electronics, television, advanced radio theory and design, math, nuclear physics and electronic engineering. Engineering Science preparatory courses. Low rate. Graduates in demand. Spacious campus: 20 bldgs., dorms, gym, playing field. Earn part of your expenses in Fort Wayne while studying. Vet. approved. Enter Dec., March, June, Sept. Catalog.

INDIANA TECHNICAL COLLEGE
9127 E. Washington Blvd., Fort Wayne 2, Indiana

Please send me free information on B.S. ENGINEERING DEGREE IN 27 MONTHS as checked.

☐ Electronics ☐ Chemical ☐ Aeronautical
☐ Civil ☐ Mechanical ☐ Electrical
B.S. DEGREE IN 36 MO. IN ☐ Math. ☐ Chem. ☐ Physics

Name .....
Address .....

Classified

ELECTRICAL EQUIPMENT & SUPPLIES

HQ for the 5 TOP QUALITY brands of

The ALL NEW "20-POUNDER"

MYSTERY PACKAGE

CARRYING CASE ALL-PURPOSE

Orig. Govt. Cost $27.00 SALE PRICE $4.95

Perfect Gift for: • Photographers • Mechanics

• Adjustable Straps • Made of HEAVY CANVAS • WATERPROOF • Sizes: 13" x 10" x 6½" • Sturdily built to support 200 pounds.

of ELECTRONIC PARTS

Worth $40.00

OUR PRICE ONLY

$3.95

It's Another THRILLING HERSHEL SURPRISE. 20 pounds of BRAND NEW usable Govt. Surplus. Perfect gift for Hams, etc.

TYPE FL

115V—400 Cycle 6700 R.P.M. Westinghouse Electric.

$3.95

BUTTERFLY CONDENSERS

YOUR CHOICE

$4.95

TYPE A 4½" Dia.

TYPE B 4½" Dia.

TYPE C 2½" Dia.

TYPE D 2½" Dia.

These units make the finest tuners for Ultra-high frequency transmitters, receivers, frequency meters, and oscillators.

TERMS: Cash with order or 25% DOWN—BALANCE C.O.D.

ALL PRICES NET F.O.B. DETROIT — MINIMUM ORDER $2.00

HERSHEL RADIO CO. TYler 8-9400

5249 GRAND RIVER Detroit 8, Michigan

PORTABLE AUDIO AMPLIFIER—1141F. Used with 625 mine detector. Compl. w/tubes, schem., cable. L.N. 12 x 4 x 4. 9 lbs. **$3.95**

LO-PASS CONSTANT K Type. 3 sections. Transmission line filter #CW53155. Provide max. atten. 6½ x 1½ x 1½. Thousands sold in our store. New w/spare button cond. **$1.95**

SUCYCLE STATIC FREQUENCY CONVERTER—Input 115V—60cy—75 watts; Output 75-90V—20 cy—15-20 watts. New. **$25.00**

INFRA RED SCORER—Input 115V/1/60, contains tubes, timing motors, meter, clutch—indicators, Brand New, Cabinet, 30 lbs—Special Value **$19.95**

TORSIONAL RELAY—Wallace & Tiernan Frequency selective. For use in applications where radio waves are control medium. Unique principles used permit this relay to be used for most exacting conditions. Reg. Price $30.00. Special while they last **$3.95**

POWER SUPPLY—RA-2B. Input 115/1/60. Output 1110-1420VDC, .450A. circuit breaker, fused, time delay. Cased, potted components. W/specs. Br. New. Ship. wt. 125 lbs. . . **$99.50**

TRIPLETT MICROAMMETER—0-500 u/a Dc, 2½" rd, bakelite case, white scale. Brand new. Special Sale. . . . . ea. **$3.49**

G. E. METER—2½" rd, 0-500 mils. New **$2.95**

SWITCHBOARD—BD-72 12 line. **$25.00**

ARC-5 XMTR—3-4MC w/tubes. Exc. . . . **$5.95**

BC456 MODULATOR w/tubes, dyna. **$5.95**

DUAL RECEIVER RACK (ARC-5) Br. new **$1.95**

METERS: O-1 Mil (3KV scale) 3½" rd. Marion—new **$3.95**

0-1 Mil (0-1000u/a scale) 4½ clear plastic—new **$5.95**

Carbon Deposit PRECISION RESISTOR—Kit **$1.00**

CERAMICONS & DISCS—Kit of 100. . . . **$1.00**

115VAC POWER RELAY—Leach 6104—DPST 30A—new **$4.95**

SSB XFORMERS (QST Article)—set of 3 **$5.00**

ISOLATION & FILAMENT XFORMERS—115V to 115V +6.3V **$1.00**

COLLINS 20 Watt MODULATION XFORMER 3 for $5.00. . . . . each **$1.95**

807W/5933 —Rugedized 807 —worth $14.00. Br. new Sylvania. doz. $15.00 . . . . . each **$1.89**

SCOPE, SIGNAL GENERATOR & POW. SUPPLY (115V 60CPS) all in one unit—w/tubes, meter. L.N. 60 lbs. **$19.95**

COLLINS CARR. MIKE XFORM. . . . 3 for **$2.00**

TUBE TYPE 1625 (for SSB Conv.) . doz. **$2.75**

RADIO SOND. TRANSMITTER—T69F/AM2—390-410MC—w/2 tubes, ant. New. . . **$1.95**

INTEGRATOR TUBES: 6107/8S212 or 6108/8S213—worth over $10.00. . . . ea. **$2.95**

BETA GAMMA COUNTER TUBE BS-8. . . . **$6.95**

GAS SWITCHING TUBE—type 1960—new **$1.00**

RCA INVERTER DYNAMOTOR ASSEMBLY. For TRC-121. Inverter input 115VDC 1.A., Output 115VAC 60 Cy. .5A., Dynamotor input 115VDC 2A., Output 630VDC .230A. On single chassis with relays & filters. Brand New. **$79.95**

REX RADIO SUPPLY CO.

88 Cortlandt Street New York 7, N. Y.

(*Continued from page 61*)

coil to give some output even at 15 kc. The discs produced a mighty peak in output in the region of 2000 to 6000 cycles, with a rise of about 10 db, which was virtually removed by the slot diffuser, as shown in Fig. 34.

It will be observed that the effect of the diffuser is not very severe at frequencies above 6000 cps and it is negligible at frequencies below 2000. Incidentally the audio-frequency signal came from an amplifier with almost zero output resistance so the cone resonance in the bass is completely damped out.

Tests for drop in output at 30° off-axis showed an average fall of 6 db above 2000 cycles with no diffuser against an average loss of 3 db with diffuser. In plain language, this means that the diffuser reduces beam effect on-axis and improves the relationship between axis and off-axis response.

On the other hand, if you do not want to be bothered with diffusers, you can always turn the offending speaker with its face to the wall or pointing upwards; this gets rid of beam effects and camouflages peaks in response to a remarkable extent because the room gets to work on the sound waves before they reach the ear of the listener. If you are completely averse to beams and peaks you can fit a diffuser *and* turn the speaker away or tilt it at a suitable angle. (*Continued Feb. issue*)

PHOTO CREDITS

Page	Credit
37, 38, 39, 40	Communications Engineering Co.
41	National Bureau of Standards
44	Delco Radio Division, General Motors Corporation
55, 56, 66	General Electric Company
58, 59, 128	Westinghouse Electric Corp.
60, 61	Wharfedale Wireless Works Ltd.
63	Hycon Electronics
65, 156	Allied Radio Corporation
70, 71	Beckman Instruments, Inc.
72	Convair
73	Bendix Aviation Corp.
94	Electronic Industries Assn.
105	Blonder-Tongue Laboratories, Inc.
118	NBC News Department
123	Rek-O-Kut, Inc.
174	Heath Company
176	Lockheed Missiles
177	National Carbon Co.

ERRATUM

In the schematic of the "One-Tube 10-Meter Transceiver" on page 59 of our June 1957 issue, tube pin numbers 6 and 7 should be transposed.

ON SALE NOW!

(compiled by the editors of *Popular Electronics* and *Radio & TV News*)

The world's first complete listings of all hi-fi equipment on the market—plus professional advice on how to pick the right unit for your own needs. If you're a hi-fi fan now—or want to get a rig soon, here's a publication that's tailor-made for you.

HI-FI DIRECTORY

PARTIAL CONTENTS

- Turntables vs. record changers
- How to buy a tone arm
- How to buy AM and FM tuners
- Full guide to tape recorders
- Detailed facts on preamps and amplifiers
- Latest information on speakers, crossover nets, speaker systems
- Enclosures and consoles
- Transformers, instruments, record clubs, books, controls, etc.

WATCH FOR THIS NEW HI-FI DIRECTORY AT YOUR FAVORITE NEWSSTAND ONLY $1.00

RADIO & TV NEWS

Classified

RATE: 50¢ per word. Minimum 10 words. January issue closes November 8th. Send order and remittance to: RADIO & TV NEWS, 366 Madison Ave., New York 17, N. Y.

RADIO ENGINEERING

COMPLETE radio, electronics theory & practice; television; broadcasting; servicing; aviation, marine, police radio. 16 or 21 months. Catalog. Valparaiso Technical Institute, Dept. N, Valparaiso, Ind.

FOR SALE

TRADE-IN TV Sets Ship Anywhere 10 in $10, 12 in $12, 16 in $17, 17 in $21 Justin Bros, Newport, Del.

NEW Electronics Surplus Transmitters, Receivers. Spare Parts ART, ARC, BC, etc. Transmitting, Industrial Tubes. Everything. Export Inquiries Invited. Solar Sales, 99-124 Hapuku Street, Aiea, Oahu, Hawaii.

ARMY Throat Microphone, New 50¢. Surplex, Box 118, Jersey City 4, New Jersey.

HI-FI Amplifiers, Speaker, tape recorders, turntables. Ham transmitters and Receivers WRL, National, Hallicrafters, Hammarlund Johnson S. Collins Easy Terms Ken-Els Radio Supply 428 Central Ave., Ft. Dodge, Iowa or 67-10th Ave. S.W. Cedar Rapids, Iowa.

RADIO & TV Tubes at manufacturers prices. Guaranteed—Send for free price list. Edison Electronic Tube Co., Menlo Park, N. J.

200 UNMARKED Ceramicons—Mixed Values. $1.00. D. Schneider, 3763 New York Ave., Seaford, N. Y.

DIAGRAMS for repairing radios $1.00. Television $2.00. Give make, model. Diagram Service, Box 672-RN, Hartford 1, Conn.

TUBES—TV, Radio, Transmitting And Industrial Types At Sensibly Low Prices. New, Guaranteed, 1st Quality, Top Name Brands Only. Write For Free Catalog or Call WAlker 5-7000. Barry Electronics Corp., 512 Broadway, New York 12N, N. Y.

DIAGRAMS—Radios, Amplifiers, Changers, $1.00 Each. Television Service Data $2.00. Unknown Models, Give Tube Layout And Part Numbers. Cable Electronics Corp., 851 10th Ave., New York, N. Y. (Formerly Kramer's Radio Service).

COMPLETE Television Sets $11.95. Jones TV, 1115 Rambler, Pottstown, Pa.

VANSICKLE Radio Supply Co. has the newest, cleanest stock of parts, kits, test equipt., Hi-Fi, etc. in their new building at 4131 N. Keystone, Indianapolis 5, Ind.

DIAGRAMS! Repair Information! Radios—amplifiers—recorders $1.00. Televisions $1.50. Give make, model, chassis. TV Miltie, Box 101RA, Hicksville, New York.

MONTIORADIO, Police-Alarm Receivers, new, used. Ladd Electronics, 111 North 41st, Omaha, Nebraska.

TUBES—Television, Radio, New, Guaranteed. Boxed. Approximately 80% off, Transmitting, Special Purpose Tubes, write Bell Electronics, 40 Canal, New York City 2.

WANTED

LABORATORY Quality Equipment and Military Surplus Electronics bought, sold. Engineering Associates, 432 Patterson Road, Dayton 9, Ohio.

AIRCRAFT And Ground Radios. Will Better Best Offer—Dames, W2KUW 308 Hickory Arlington, N. J.

CYLINDER and old disc phonographs. Edison, Conqueror, Idelia, and Oratorio models. Berliner Gramophones and Zono-o-phones, Columbia cylinder Graphophones, and coin-operated cylinder phonos. Want old catalogues and literature on early phonos prior to 1919. Will pay cash or trade late hi-fi components. Box 50 c/o Radio & TV News, 366 Madison Ave., New York 17, N.Y.

WANTED: Receiver R5/ARN-7, MN-62A Transceivers, RT18/ARC-1, AN/ARC-3, BC-788C, I-152C, Collins, Bendix equipment, Test Sets, Dynamotors, Inverters. We pay highest prices. Advise quantity, condition, price first letter. Aircraft Radio Industries, Inc., 70 East 45th St., New York City 17, telephone LExington 2-6254.

CASH Paid! Sell your surplus electronic tubes. Want unused, clean transmitting, special purpose, receiving, TV types, magnetrons, Klystrons, broadcast, etc. Also want military & commercial lab test and communications gear. We swap too, for tubes or choice equipment. Send specific details in first letter. For a fair deal write, wire or telephone: Barry, 512 Broadway, New York 12, N. Y. WAlker 5-7000.

MANUFACTURERS Rep, hi fi items only, looking for new articles. NY, NJ area. Box No. 562 c/o Radio & TV News, 366 Madison Ave., New York 17, N. Y.

ELECTRICAL EQUIPMENT & SUPPLIES

GOVERNMENT Surplus Receivers, Transmitters, Parabolic Reflectors, Picture Catalog 10¢ Meshna Malden 48 Mass.

HIGH FIDELITY

DISGUSTED Of "HI" HI-FI Prices? Unusual Discounts On Your High Fidelity Requirements. Write Now. Key Electronics 120 Liberty St., New York 6, N. Y. EVergreen 4-6071.

WANTED: Technician—Salesman for partnership with record specialist in proposed hi-fi record shop in wealthy, progressive Puerto Rico. $10,000 required. No competition. Write Classified Box 561, % Radio TV News, 366 Madison Ave., N. Y. 17, N. Y.

MISS Our Ad? See Advertisers' index. Key Electronics, 120 Liberty Street, N. Y. 6, N. Y.

REPAIRS & SERVICING

HIGH Fidelity Speakers Repaired. Amprite Speaker Service, 70 Vesey St., N. Y. 7, N. Y. BA 7-2580.

TAPE RECORDERS

RECORDING Tape—1800' $1.84, 1200' $1.44. Guaranteed. Catalogue. Broadcast Tape, P. O. Box 231A, Wallingford, Conn.

RECORDERS. HiFi, hifi components, tapes, Free Wholesale Catalog. Carston, 215-R E. 88 St., N. Y. C. 28.

TAPE Recorders, Tape. Unusual Values. Free catalog. Dressner 69-02 R, 174 St., Flushing 65, N. Y.

WHOLESALE Catalog 10¢. Recorders! Tapes! Typewriters! Radios! Towers, #155, Philadelphia 5.

CORRESPONDENCE COURSES

USED Correspondence Courses and Books sold and rented. Money back guarantee. Catalog free. (Courses bought.) Lee Mountain, Pisgah, Ala.

BE A Spy! Correspondence course on wire tapping, bugging, telescopic sound pickup, recording techniques, microphotography, invisible and remote photography, telescopic and aerial photography. Lessons in surveillance, tailing, and use of equipment. Complete course $22.50. Q. Carrier Co., 734 15th St. N.W., Washington, D. C.

DIGITAL Computers And Data Processing. Complete correspondence course covering theory of operation and applications with a comparison of 10 different medium sized systems. Complete course $25.00. Q. Carrier Co., 734 15th St. N.W., Washington 5, D. C.

GUIDED Missiles And Satellites. Correspondence course covering Missile Aerodynamics, Internal Control and Navigation Systems, Ground Control & Telemetering, and Rocket Engines. Complete Correspondence course with plans for Hobbiest Missile $38.50. Q. Carrier Co., 734 15th St. N.W., Washington 5, D. C.

BUILD Your own "A" Bomb. Complete correspondence course covering Atomic "Fission" and "Fusion" bombs and Reactors; Fundamentals, Applications, and Nuclear Engineering. Complete 2,500 page industrial course $10 with order & $4 per lesson. Q. Carrier Co., 734 15th St. N.W., Washington 5, D. C.

TRANSISTOR Genius! Learn transistor fundamentals, applications. Audio, RF, High Frequency design. Complete correspondence course with laboratory experiments and parts included. $32.50. Q. Carrier Co., 734 15th St. N.W., Washington 5, D. C.

RADAR & Pulse Communication. Correspondence course covers Principles, Antennas, Transmitters, Receivers, Magnatrons, Klystrons, Backward Wave Tubes, Sea Search, Air Search, Fire Control, Voice Multiplex. Includes section for FCC Radar endorsement. $38.75. Q. Carrier Co., 734 15th St. N.W., Washington 5, D. C.

INSTRUCTION

COMPUTER plans $3.00. New transistor robot plans $1.00. Robot construction manual $5.00. Only complete course in electronics under $100.00. for complete information on automation computers, robots, write: E. B. E., 1015 Atkin Ave., Salt Lake City 6, Utah.

USED Correspondence Courses, Educational Books Bought, Sold, Rented, Catalog Free, Vernon's 624 Mohawk, Rossville, Ga.

ENGINEERING Degrees, EE Option Electronics earned by home study. Residence classes also available. Pacific International University (Operating as a College of Engineering only at present), 5719-C Santa Monica Boulevard, Hollywood 38, California.

HQ for the 5 TOP QUALITY brands of

TUBES

AT SENSIBLE PRICES!

• Individually boxed • First quality only
• Brand New • 90-DAY RETMA guarantee

WRITE FOR LATEST TUBE CATALOG FREE!

2BP1	$ 3.95	403A	.90	5642		1.00
CL-2	10.00	403B	2.90	5646		4.00
2C35	2.00	404A	12.50	5651		1.00
2C39A	30.00	416B	30.00	5654		1.35
2C40	6.75	417A/5842		5656		3.00
2C43	6.50		12.00	5687		2.25
2C51	2.75	*450TL	45.00	5687WA		4.50
2C53	9.75	KU610	3.50	5691		5.00
2E24	2.25	GL673	12.50	5692		5.00
2K25	13.50	703A	.95	5693		4.50
2K45	35.00	7218	7.00	5703WA		3.95
2K55	15.00	*750TL	30.00	5718		1.75
3B24	1.90	803	1.50	5719		1.48
3B24W	4.25	805	4.00	5725		1.50
3B29	4.75	807	1.10	5726		.65
3C45	6.75	807W/9933	1.50	5744		1.00
3J30	25.00	813	8.75	5749		.95
*4-65A	15.00	814	2.50	5763		1.25
*4-125A	30.25	815	3.25	5812		1.00
*4-250A	35.00	829	1.75	5814		1.00
*4-400A	45.00	830B	.50	5819		2.95
4B24/EL3C	4.50	832	6.00	5840		1.50
4P46A	30.00	833A	8.75	5881		1.50
5C22	24.00	834	2.00	5910		.45
6AK5W	1.00	837	1.25	5915		.50
6C21/4E0TL		838	.40	6111		4.50
	13.50	866A	1.75	6612		4.50
6J4	1.70	866JR	1.60	6130/3C45		4.75
F033	4.25	872A	.90	6161		45.00
2.5RT6	2.00	872A (BK)	2.75	6201		2.50
VC50/32V	8.00	918	1.10	6350		1.50
RK-60/1641		927	.95	6550		4.20
	1.15	954	.10	6059		3.25
KT66	2.30	955	.30	8020		1.00
HY69	2.10	956	.30	9001		.70
VXR-150	1.00	957	.30	9002		.50
GL299	1.50	958A	.35	9003		1.25
304TL	12.50	961	.20	9004		.25
307A	.90	1625	.25	9006		.50
357A	14.00	5517	1.00	and many others		
371B	.75	5636	2.75	*(Surplus)		

WE ARE FACTORY AUTHORIZED DISTRIBUTORS OF CBS-HYTRON, EIMAC, PENTA, JOHNSON, GONSET, A & S & W.

Electronic Equipment Specials

DYNAMOTOR. Vy compact. 12 VDC in. 420 VDC @ 250 ma. int. cut. (160 ma. cont.) $9.95
Lots of 3, each 8.95

RCA PLATE TRANSFORMER

Pri: 115 V.-60 Cy., Tapped at 105V. Secondary 1100 volts CT @ 250 Ma.—6.3 V, at 5 Amps., 5 volts @ 3 Amps. (125 volt bias winding). Ideal for low-power transmitters, power amplifiers, etc. Fully cased. Brand new in original cartons $4.95

- T-23/ARC-5 Xmtr—100 to 156 Mcs. Like new w/tubes $14.95
- T-12A/ARC-5 Xmtr—Same as T-23 except 100 to 144 Mcs. 13.95
- Shallcross 0-5, 10, and 20 Kv. Kilovoltmeter—Brand New, in Sealed Cartons. Reg. $255.00. Special 37.50
- Aerovox 50 mfd/450 VDCWV ..... .90
- Prop-Pitch Motors (about 50 lbs.). New and/or Like New 25.00
  F.O.B. Atlanta, Ga. via Truck.
- Glas-Line Non-Metallic Guy Line $2.89 per 100'
- 115 VAC/60~ Transformer Secondary: 28 volts @ 10 Amps. 4.50
- 16 Hys-450 Ma. Choke (6000 Volts Insulation) Compact—oil-filled 9.50

GEIGER COUNTERS—RCA . . . Brand new, jobber boxed close out prices—write for price—6 different models.

INFRA-RED CL-2 LAMP

The device that makes license free transmission a reality! 2 way voice or MCW can be transmitted over concentrated invisible infra-red rays. Information on how to construct a 2-way transmit-receive station available. See p. 93, Oct. 57, Radio-Electronics.
CL-2 LAMP, w/info (worth $50) $10.00

2-COLOR TUBE CARTONS

Keeps your tube stock neat. New safety partition prevents tube breakage. Distinctively lithographed in glossy red and black. The most distinctive tube carton available today. Minimum quantity 100 of any one size. Write for case lot prices. Packed 1000 to case.

SIZE	FOR TUBE PER 100
Miniature	6AU6, etc. 1.00
GT	6SN7, etc. 1.25
Large GT	1B3, etc. 1.50
Large G	5U4G, etc. 2.00

WHITE GLOSSY BOXES
Completely blank. No printing or color. Otherwise same as above. Same high quality, same low prices. Specify "WHITE" when ordering. When color is not stated, 2 color cartons will be shipped.

TUBE STACKERS

White glossy only. Ministacker holds 10 Mini. tube cartons; "GT" stacker holds 10 "GT" cartons.

SIZE	PER EACH
Ministacker	.12
GT	.02

$12.50 Per Case of 1000 STACKERS

All cartons & stackers F.O.B. N.Y.C.

WRITE FOR "BARRY'S SEPT., '57 GREEN SHEET"

TERMS: 25% deposit with order, balance C.O.D. All merchandise guaranteed for cost of merchandise only. F.O.B. N.Y.C.

Subject to price variation and stock depletion
MINIMUM ORDER $10.00

BARRY ELECTRONICS CORP.

512 Broadway, Dept. RE, N.Y. 12, N.Y.
Phone: WAlker 5-7000

"TAB" Tubes Tested, Inspected, Boxed
Guaranteed New FIRST QUALITY Surplus

0A2	.90	6BJ6	.72	12AT6	.59	117Z3	.69
0B2	.72	6BN7	.99	12AT7	.69	117Z6	1.10
0C3	.94	6BL7	1.95	12AU6	.63	4J34A	2.00
0D3	.80	6BN6	1.08	12AU7	.69	2C51	3.00
0Z4	.50	6BQ6	1.10	12AX7	.79	5BQ1	.68
1A7	1.00	6BZ7	1.25	12BA6	.65	3D21	5.00
1B3	.78	6C4	.49	12BA7	.99	717A	$5/$1
1R5	.78	6C6	.49	12BD6	.59	4-125A	32.00
1S4	.78	6CB6	.60	12BE6	.59	4-250	35.00
1T4	.78	6CD6	1.49	12BF6	.59	4E27	7.00
1U4	.68	6H6	.59	12BH7	.96	4PR60	35.00
1U5	.89	6J5	.59	12BY7	1.00	4X150	15.00
1X2A	.68	6J6	.59	12DE7	.99	4X250	39.00
3Q4	.68	6K6	.59	12CU6	1.45	4X500	38.00
3Q5	.86	6K7	.79	12SA7	.69	5BP1	1.98
3S4	.68	6L6	1.19	12SG7	.69	5BP4	1.58
3V4	.99	6S4	.59	12SH7	.89	5T	4.00
5B4	1.25	6F8	.99	12SJ7	.75	100T	7.00
5U4	.89	6AB7	2/$1	12SK7	.75	832T	20.00
5V4	.89	6SB7	1.19	12SQ7	.69	388A	1.00
6V3	.89	6SC7	.89	19BG6	2.15	418A	14.00
6AB4	.59	6SG7	.79	19T8	1.16	450T	43.00
6AC7	.79	6SH7	.69	25BQ6	1.39	805	1.19
6AG7	.89	6SJ7	.69	25L6	.72	808	1.00
6AH6	.99	6SK7	.72	25W4	.77	809	3.00
6AK5	.89	6SL7	.89	25Z5	.72	810	10.00
6AL5	.69	6SN7	2/$1	25Z6	.79	811	3.00
6AQ5	.66	6SQ7	.74	EL34	3.49	813	3.00
6AS7	3.00	6SR7	.79	EL37	2.49	833	8.00
6AT6	.49	6T8	.98	35L6	.59	914	3.00
6AU4	1.25	6U8	.98	35W4	.52	915	2.00
6AU5	1.19	6V6	1.39	35Y4	.69	8298	8.00
6AU6	.89	6W4	.79	35Z5	.57	8332A	6.00
6AX4	.79	6W6	.89	50A5	.69	8417	3.50
6BA6	.59	6X4	.39	50B5	.69	6146	3.58
6BA7	1.00	6X5	.49	50C5	.69	5879	1.20
6BD6	.69	6Y6	.89	50L6	.69	5881	2.85
6BE6	.69	7N7	.89	KT66	3.29	6550	3.50
6BG6	1.50	12AL5	.59	75	.59		
6BH6	.79	12AQ5	.75	80	.59		

Write for Complete Tube List! Discounts to Qty. Buyers
TUBES WANTED! WE BUY! SELL & TRADE!

NEW "TABTRON" SELENIUM BRIDGE RECTIFIERS. ONE YEAR GTD!
FULL WAVE BRIDGE *WRITE for CATALOG*

CURR. CONT.	18VAC 14VDC	36VAC 28VDC	72VAC 56VDC	144VAC 118VDC
1AMP	$ 1.50	$ 2.30	$ 5.30	$ 13.00
2AMP	2.35	3.38	6.45	16.00
3AMP	3.00	4.15	9.60	19.00
6AMP	4.45	8.85	19.50	35.00
10AMP	6.50	12.60	27.90	49.00
12AMP	8.10	15.90	32.75	57.35
24AMP	16.15	32.40	63.60	144.50

BAT. CHARGER STACKS. FAN COOLED REPLACEMENT OR CONVERSION. Discounts to Qty. Users

CR20R	CR32D	SR16R	SR18C	BN16R
10VAC/CT	16VAC/CT—	INPUT—18VAC		
6VDC 100A	6VDC/100A	12VDC/50AMP	80A/40A	
$14	$20	$24	$26	$20

QUICK DELIVERIES ALL TYPES 24 HOURS!

AC to DC POWER SUPPLY KITS!

115VAC Input Transformer & Full Wave Bridge Rectifier for 12VDC @ 3AMPS, or 24VDC at 1AMP RECTRAN KIT RT1K $4.50 RT1W Assembled & Wired..... $6.50 RT2K Kit 12 or 18VDC at 6 AMPS.. $9.00 RT2W Assembled & Wired..... $14.75 For Transistors! Filtered Power Supply Kit used to power transistor circuits, amplifiers etc. Delivers 12VDC at 2AMPS filtered less than 0.5% ripple or 28VDC at 1A TPS2 Kit $16, TPS2W assembled & wired $27.
Radio & TV Rectifiers 75 ma, 49c. 5 for $2, 20/$7 100ma/89c, 6 for $3, 11/$8; 250ma 79c, 6/$4

GTD TEST EQUIPMENT

TS174/FREQMTR 20-250mc's..$200; TS164AR $95
1-222/8-154135-230mcs. $35; TS150/150-200mcs $14
OAF/140-260mcs....$36; TS127U/375-725mcs $29
1-126/15-264180-238mcs $72; TS3AP/2700-3400mcs $145
TS47/40-500mcs.....$199; TS309/5-70mcs $50
TS184/400-430mcs.....$43; RM29A $5 @. 2/$9
RCA M17503A Field Intensity Mtr 150KC-30mcs $175
TMV18B/150KC-20mcs $50; TS35A/8.7K-9Kmcs $250
RCA 715B SCOPE.....$250; DUMONT 241 $200
TS34AP SCOPE.....$75; RCA/TV-MI-26135 $175
RCA155/3" SCOPE....$30; RCA160B/5" SCOPE $65
OAX HYDROPHONE...$45; G.R.561VT/BRIDGE $195
WESTON LAB 45/150VDC $35; MIT SYNCSCOPE $72
G.E. YYZ SCALES...$100; FD9/FM MONITOR $100
NEW 0-130V @ 1.25AMP VARIAC TYPE VAR/XFMR $6.98

WE BUY—SELL & SWAP AS WELL!

FINEST HI-FI RECORDING TAPE
1200 Ft.—7" Reel *Money Back Gtd.* **$1.45** *Lots of 3*

Highest quality controlled plastic base tape made by new Erin Sheen process. Precision coated & Slit. Odd. Counting output. Splice Free. Freq. 7½ IPS 40-15KC Oxide Wnd In.
New 1st Quality "Mylar" 2400 Ft.—7" Reel Ferro Erin Processed Recording tape..... $4.49, 3 for $12

NEW TYPE "GE" PHONO CARTRIDGES
ORIGINAL BOXED G.E. MONEY BACK GTD.

4GD51/LP or 4GD53/78 DIAMOND	$15
4GD50/LP&78 TRI-PLAY SAPPHIRE	$7
4GD52/LP&78 TRI-PLAY DIAMOND & SAP	$17
4GD53/LP&78 TRI-PLAY DIAMONDS	$25

KITS! "TAB" *THE BEST* KITS!
All Kits Contain Most Popular Values & Sizes

Kit 25 Precision Resistors	Kit 25 Power Resistors
Kit 26 Switches	Kit 75 Mica Cond's
Kit 3 Transistor Transf.	Kit 6 Crystal Diodes
Kit 150 Carbon Resistors	Kit 250 Ft. Hookup Wire
Kit 42 Panel Lamps	Kit 10 Fuses
Kit 12 Electrolytic Cond's	Kit 100 Ceramic Cond
Kit 15 Volume Controls	Kit 18 Rotary Switches
Kit 36 Tube Sockets	Kit 6 Crystals & Holders
Kit 50 Tubular Cond's	Kit 65 Inductors & Coils
Kit 500 Lugs & Eyelets	Kit 8 Microswitches
Kit 10 Xmit Mica Cond's	Kit 10 Wheat Lamps
Kit 5 Lbs. Surprise Kit	Kit 40 Insulators
Kit 100 Xmit Mica Cond's	Kit 65 Insulated Resist.
Kit Encapsulation Fluid	Kit TV Knobs
Kit Volume Control Fluid	Kit Crystal Cement & Varnish

BUY 10 KITS GET ONE FREE! EACH KIT **99c**

DIAMOND PHONO-NEEDLES
REGISTERED ONE YR. GUARANTEED
ALL MAKES LP&78—ONE DIAMOND $7; TWO DIAMONDS $14; DIAMOND & SAPPHIRE $8; TWO SAPPHIRES $2.30; ONE SAPPHIRE LP or 78 $1.40 @
PLEASE SEND CARTRIDGE NAME & NUMBER

"TAB" 111 NY LIBERTY ST., N. Y. 6, N. Y. PHONE: RECTOR 2-5345

TERMS: Money Back Guarantee. Our 13th year. $3 min order F.O.B. N.Y.C. Add ship charges or fee C.O.D. 25% Dep. Prices shown subject to change.

INDEX OF *Advertisers*

DECEMBER 1957

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

ADVERTISER	PAGE
Acoustic Research, Inc.	16
Acro Products Company	108
Airex Radio Corp.	178
Allied Radio Corp. 9 129, 130, 131, 132, 133, 134, 135,	136
Altec Lansing Corporation	13
American Electronics Co.	176
Ampex Audio Inc.	98
Amphenol Electronics Corporation	168
Arkay	118
Arrow Sales, Inc.	188
Ashe Radio Co., Walter	26
B & K Manufacturing Co.	75
Baltimore Technical Institute	182
Barry Electronics Corp.	193
Bendix Radio	146
Burstein-Applebee Co.	171
CBS-Hytron	29
C & H Sales Co.	180
Candler System Co.	185
Capitol Radio Engineering Institute	153, 154
Carston	191
Castle TV Tuner Service	187
Center Electronics Co., Inc.	184
Century Electronics Co., Inc.	137
Channel Master Corp.	19
Cleveland Institute of Radio Electronics	11
Columbia Electronics	182
Coyne Electrical School	128, 146, 188
Cutick Electronics	189
Dance Mfg. Co.	185
DeVry Technical Institute	5
Dover Publications, Inc.	22
Dressner	98
Duotone Co., Inc.	190
Dynamic Electronics-New York, Inc.	107
Edmund Scientific Co.	144
EICO	35, 36
Electronic Chemical Corp.	146
Electronic Engineering Co.	171
Electro-Voice	101, 102, 103, 104
Erie Resister Corporation	100
Esse Radio Co.	151
Fairchild Recording Equipment Company	106
Fair Radio Sales	172
Fisher Berkeley Corporation	107
Fisher Radio Corporation	30, 31
G & G Radio Supply Co.	143
Garfield Company, Oliver	144
General Electric	20, 21, 111
Goodheart, R. E.	188
Sam Goody Record Club Inc.	165
Grantham Schools	156
Harvey Radio Co., Inc.	120
Heald Engineering College	184
Heath Company	76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91
Henshaw Radio Supply	185, 187, 189, 191
Hershel Radio Co.	192
Hi-Fi Annual & Audio Handbook	161
Hi-Fi Directory & Buyers' Guide	159, 192
Hi-Fi Music & Review	121
Indiana Technical College	191
Instructograph Company	171
International Business Machines Corp.	116, 117
International Correspondence Schools	15
International Radio & Electronics Corp.	190
International Resistance Company	138, 139
J. J. Candee Co.	183
Jackson Electrical Instrument Co.	8
Jones Box Corp., Jesse	192
Karlsen Associates, Inc.	107
Kester Solder Company	128
Key Electronics Company	180
Kingston Electronic Corporation	160
Lafayette Radio	124, 125
Lampkin Laboratories, Inc.	144
Lansing Sound, Inc., James B.	93
Lektron	191
McGee Radio Company	147, 148, 149
M. R. Company, The	188
Mallory & Co., Inc., P. R.	Fourth Cover
Majestic Electronics Ltd.	183
Merit Coil & Transformer Corp.	165
Milwaukee School of Engineering	165
Moss Electronic Distributing Co., Inc.	140, 141
MusiCraft	113
National Radio Institute	27, 28
National Schools	17
Neshaminy Electronics Corp.	97
North American Phillips Co., Inc.	99
Offenbach-Reimus	190
Olson Radio Warehouse	145
Orradio Industries, Inc.	188
Pacific International University	189
PACO Electronics Co., Inc.	94
Peak Electronics Company	164
Perma-Power Company	126
Photography Annual	174
Pickering & Company, Inc.	18
Pilot Radio Corp.	92
Popular Boating	122
Precision Electronics, Inc.	105
Progressive "Edu-Kits" Inc.	167
Pyramid Electric Company	14
Quality-Electronics	186
Quietrole Company	188
RCA Institutes, Inc.	119
RW Electronics	170
Radio & Electronics Surplus	184
Radio-Television Training Association	25
Radio & TV News	179
Rad-Tel Tube Co.	175
Raytheon Manufacturing Company	Second Cover
Reeves Soundcraft Corp.	Third Cover
Rek-O-Kut Co., Inc.	96
Rex Radio Supply Co.	192
Rider Publisher, Inc., John F.	155
Rinehart & Co., Inc.	150, 173, 190
Rohn Manufacturing Co.	23
Ronette Acoustical Corp.	113
Sams & Co., Inc., Howard W.	24, 158
Schober Organ Corp., The	181
Scott, H. H.	95
Scott-Mitchell House, Inc.	190
Service Instruments Corp.	126
Sonotone Corporation	109
Sports Cars Illustrated Directory	122
Sprague Products Co.	98
Sprayberry Academy of Radio-Television	33
Stan-Burn Radio & Electronics Co.	152
Standard Line Electric Company	181
Sunair Electronics, Inc.	123
"TAB"	194
Tandberg	112
Technical Appliance Corporation	157
Tech-Master Corporation	100
Telematic Industries, Inc.	32
TeleTest Instrument Corp.	187
Tenna Manufacturing Co., The	189
Terado Company	128
Texas Crystals	166
Thorens Company	12
Transvision, Inc.	176
Tri-State College	187
Uncle Sam Recordings	98
United Audio Center	186
United Radio Company	182
University Loudspeakers, Inc.	10
Valparaiso Technical Institute	186
Video Electric Company	127
Weller Electric Corporation	169
Western Radio	183
Weston Electrical Instrument Corp.	175
World Radio Laboratories	185
Wuerth Tube-Saver Corp.	171
Xcelite, Inc.	126
Yeats Appliance Dolly Sales Co.	167
Your Career in Electronics	182
Zenith Radio Corporation	6, 7
Zytron Tube Corporation	184

this Christmas gift is yours...
when you buy SOUNDCRAFT TAPE
fill your home with
SOUNDS OF CHRISTMAS
a high fidelity recording on your own reel of Soundcraft Tape!

Adeste Fideles
Silent Night
Rudolph the Red Nosed Reindeer
Noel
Jingle Bells
God Rest Ye Merry Gentlemen

performed by **The Street Singer Caroleers,** orchestra and chorus under the direction of world famous arranger-composer Dewey Bergman.

The Spirit of Christmas Captured in Sound! — the best-loved of traditional Christmas melodies...joyous... nostalgic...reverent... as much a part of the holiday season as decorations on the tree!

A collector's item... not for sale at any price ...this 15-minute high fidelity recording is yours FREE, except for postage and handling, when you buy any 7" reel of Soundcraft Tape. See your Soundcraft dealer now, or write us for his name...he will tell you how you can get "SOUNDS OF CHRISTMAS" recorded on your tape. Not only the "SOUNDS OF CHRISTMAS" but the sounds of all the year sound better on Soundcraft Tape!

REEVES
SOUNDCRAFT
CORP.
10 E. 52nd St., New York 22
West Coast—338 N. LaBrea, Los Angeles 36, Calif.

...another
MALLORY

. . . another
MALLORY
service-engineered
product

Mallorys under Water...

prove MALLORY "GEMS" moisture proof

To demonstrate how well Mallory "Gem" tubular capacitors resist moisture, we put some in plastic tubes filled with water. Months later, their internal resistance remains unchanged . . . proving there has been no moisture absorption.

Sure, you don't expect to submerge the capacitors you install. But when you're looking for top performance, even under the toughest humidity—always ask for Mallory "Gems."

Get your stock today from your Mallory distributor. He carries them in all popular ratings for by-pass and coupling applications.

P R MALLORY & CO Inc.

MALLORY

• Capacitors • Vibrators • Switches • Controls
• Resistors • Rectifiers • Power Supplies
• Filters • Mercury and Zinc-Carbon Batteries

P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA